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LECTURES ON MEDICAL DISEASES

FOR NURSES

LECTURES
ON
MEDICAL DISEASES
FOR NURSES

BY

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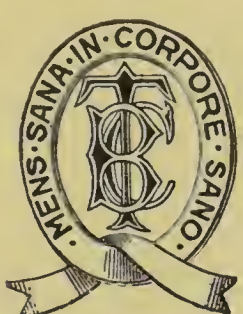

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PREFACE

THESE lectures were first published serially in the *Nursing Times*, and as, from the reception they met with, they seem to supply a want on the part of hospital nurses, they are now issued in book form to make them more accessible for study and reference.

I am far from claiming any completeness for the series—the many omissions entailed by the strictly limited space at my disposal alone put this out of court. My aim has been merely to give, within these limits, an account of medical diseases which shall be intelligible to nurses and sufficiently instructive to add to the interest of their cases.

DAVID FORSYTH

LONDON, W.,
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FOR NURSES

CHAPTER I

INTRODUCTION

In the following pages I propose to give an account of the various medical diseases which a nurse is likely to meet in the ordinary course of her work. The need for some such guide is, I believe, pretty generally felt by nurses themselves; and for a reason not far to seek. During the past generation the remarkable transformation in the status of nursing has brought into existence a body of professional women, educated and intelligent, who, not content merely in carrying out their duties by a mechanical routine, are able to understand and are keen on understanding as much about their cases as possible. The facilities, however, for widening their outlook have hardly kept pace with the progress of their calling. At the present day, for example, a nurse, while still passing through her training, is so fully occupied in learning the practical nursing of patients as to find little or no opportunity to acquaint herself with their diseases. Later, when, perhaps for the first time, she feels the want of some knowledge in this direction, she finds that post-graduate study, as understood among doctors, is not

available for her. True, one or two of the more enlightened training-schools have, to their credit, taken steps to remove this reproach, but, so far as the needs of the average trained nurse are concerned, post-graduate teaching simply does not exist.

In all probability the nurse, with the intention of bridging over this gap, provides herself with a textbook of medicine, resolving to make herself mistress of its contents. But with what success? The book, she finds, has been written for medical men, and not only is she a stranger to the philosophic system underlying the whole of modern medicine, but the very terms are as uncouth in her ears as a foreign tongue. Within a few weeks the book is probably relegated to the bottom of her travelling-trunk, where its repose is rarely, if ever, disturbed.

It is, surely, in this lack of opportunity rather than in any lukewarm interest in their work that we can find the explanation of the curiously limited medical knowledge of so many nurses, even the most capable and experienced. Thus, I have known a nurse, expert enough in tending a patient with transverse myelitis, frankly confess herself at a loss to say what transverse myelitis really is. Another, unremitting in her care of a patient with ulcerative colitis, was nevertheless hard put to explain the rationale of the very nursing acts she performed so well. And, of course, many a nurse will be regular as clockwork in administering her four-hourly medicines, without, however, understanding why the particular drug has been ordered, how it acts, or by what means it will control the disease.

But some may say these are matters for doctors, not for nurses, whose province lies in another direction. It may be asked how (since nursing is the handmaid of medicine—serving, waiting, helping) can it benefit a patient for both his physician and his nurse to be acquainted with the circumstances of his disease? Will not this mean confusions,

contradictions, even a divided authority? I think not. In the first place, the nurses who are keenest to learn are also, in my experience, the nurses who best appreciate the limits of their province, and who have intelligence enough to realize that, at best, a nursing training can merely skim the surface of the sea into which medical science ploughs deep. Moreover, that nursing service which is based on an uninformed and unenlightened obedience alone can never compare with that other, which, in addition to obedience, is quickened with understanding and warmed with the sympathy which comes from realizing difficulties and appreciating the skill that overcomes them. This latter sort, however, though eminently desirable, cannot be ensured without knowledge; and, as a small step towards its realization, this small handbook, written for the special use of nurses, and dealing with the diseases which lie within the practice of a physician, may be of use.

CHAPTER II

WHAT IS A DISEASE?

To begin with, we need first to form a clear idea of what is meant by "a disease." In the minds of many a disease is still regarded more or less as a "thing" that "attacks" a patient. It settles on his kidneys, or shifts from one joint to another, or breaks out from his body as a rash on the skin, and so on. From this point of view we may perhaps say that the relation between the disease and the patient is, as it were, that between a hostile troop of soldiers and the peaceful countryside it ravages. The injury worked by the disease on this or that organ would be compared with the damage inflicted by the enemy on this village or that bridge, while the effects of the disease would be paralleled in the confusion and disturbance of the whole neighbourhood. This analogy, however neatly it can be worked out in its details, is nevertheless misleading unless we perceive exactly what item in it stands for the disease itself. Is it the hostile band that inflicts the damage? Or is it the damage itself? Or is it the confusion and disturbance of the inhabitants and their daily avocations? Which of these would represent the disease?

Take typhoid fever, for example. In this instance we have first the typhoid bacilli; but clearly these are not the disease, for you can have typhoid bacilli by the million in a test-tube and yet not have typhoid fever. The disease

obviously implies a patient to be acted upon as well as a bacillus to act. Again, in typhoid fever we constantly find ulcers of the small intestines. Are these the disease? No, again; because typhoid fever implies much more than ulcers of the intestine. It implies headache, fever, an enlarged spleen, delirium, and so on. We are driven, therefore, to the conclusion that when we speak of typhoid fever we mean neither the bacillus that causes the disease nor the anatomical changes in the bodily organs accompanying the disease; but, instead, the sum total of the disturbance into which the body is thrown when exposed to the influence of typhoid bacilli.

This particular instance at once brings us to a general understanding of the term "a disease." A disease—it is important to remember this—a disease is merely a disturbance of the bodily functions; or, putting it more formally, **any condition of the body** (including, of course, the mind) **in which one or more of its functions is disturbed is a disease.** Typhoid fever, a broken leg, writer's cramp, ptomaine-poisoning—in each of these one or more of the bodily functions are disturbed, and therefore each is a disease.

So far, so good. But now let us go a step farther. Our definition, you will have noticed, is a net cast very wide: it includes among the diseases all disturbances of the body, whether severe or mild, and whatever the cause. Now, it is well known that certain diseases are customarily associated with demonstrable alterations in one or other organ; these diseases, therefore, are called **organic** diseases. In others, however, every organ appears healthy, even under the microscope, and yet the patient has definite symptoms of disease; these are **functional** diseases. Thus, a man has pain after his meals, and, when examined, a cancer is felt in his stomach; we say the man has an organic disease of the stomach. Another man—a quick-luncher, let us

say—also has pain after his meals, but his stomach on examination is found to be normal; the case is one of a functional disease of the stomach.

Of course, as soon as we approach these functional diseases, which, be it remembered, account for the majority of patients who require medical treatment, we are bound to open up the important subject of the influence of the mind in producing the symptoms of disease. This matter I shall hope to deal with more fully later on; but for the present it is necessary to realize that this influence is not only very real, but in medical practice is almost ubiquitous in its effects. Moreover, in many cases, even though the symptoms be referred exclusively to one organ, say the stomach, it is nevertheless the mind, and not the stomach, that is primarily at fault. These are facts which, though I have stated them only briefly, are worthy of serious consideration. Indeed, it can hardly be too strongly emphasized that no one, physician or nurse, can hope to do the best for their case until these facts have been allowed to colour the very atmosphere through which they regard their patient. And yet, as we all know, nothing is commoner than to hear a case lightly dismissed with the remark, "Oh, there is nothing really wrong; it's all imagination," or "nerves," or what not. If by "really wrong" is meant "organically wrong," well and good, though even then it is a grievous error to suppose that functional diseases are not to rank as real diseases; and certainly, so far as the cure is concerned—and, after all, how else can physician and nurse justify themselves?—they are the cases in which the healing art can achieve some of its greatest successes. No doubt some functional conditions, provided they are serious, and perhaps incurable, will be universally admitted as diseases, but the same is not so readily allowed of mild and curable conditions. A woman, for example, is shut up in a lunatic asylum on account of

chronic melancholy; admittedly this is an instance of disease. But another woman, harassed by the monotonous round of housekeeping, becomes tired and depressed, suffering much from headaches and vague pains about her body. Sent away for a few weeks' holiday, she returns vigorous and bright again. Was this an instance of disease? By our definition, certainly; and, we must add, from the point of view of everyday practice as well. Perhaps some readers may at first find some difficulty in granting this, more particularly if their experience of diseases is limited to those which alone are admitted to the average hospital ward. Yet, both for the good of their patients and for their own success, it is well to realize that the very fact of a patient seeking medical help is a guarantee that something is amiss. We can hardly imagine any man or woman, all of whose functions, bodily and mental, are working smoothly, giving two thoughts to doctors or nurses; as soon would a contented man start a suit in Chancery.

The Causes of Diseases.

We now come to another question—namely, What are the causes of diseases? Since, broadly speaking, anything that interferes with the normal working of the body or mind may be a cause of disease, we must look far afield for its sources. In the first place, the healthy development of the body, even *in utero*, may be so deranged that the child is diseased even at the moment of its birth. Among these *congenital* diseases may be instanced congenital heart disease and congenital hydrocephalus. Again, a child, though healthy at birth, may inherit some constitutional taint which perhaps will become manifest in later life. Such *hereditary* diseases form a group by themselves, prominent among them being placed many nervous affections. Then again, the growth of the body is dependent on the quality and quantity of its nourishment. Thus, certain articles of

food essential to health may be lacking in a patient's diet, and a diseased condition may result—scurvy, for example. Or, on the other hand, food (including beverages) may be taken in excess, thus leading to disease—as, for example, obesity, fatty disease of the heart, and the results of excessive alcohol or tea drinking. We must therefore admit *defective diet* as a cause of disease.

Another fertile cause is found in *overwork*, *worry*, and *mental strain*, each of which at the present day figures prominently in the production of diseases both of the body and of the mind. Next we have the important group of *poisons*, including not only those like opium or veronal, which produce their results rapidly, but others which are absorbed into the system only slowly—often, of course, in connection with some dangerous trade. As examples we have lead-poisoning and arsenical poisoning. Yet again we have *injury*, or traumatism, to give it its medical name. Another group of causes is purely *physical* in its nature—for example, excessive heat, causing heat-stroke; cold, producing chilblains; atmospheric conditions setting up mountain-sickness and diver's paralysis; electricity and lightning-stroke. In this connection we must mention *chill*, a cause which, however successful in eluding the explanation of science, is universally admitted as responsible for many complaints.

Finally, we have the important group of *parasites*, both vegetable and animal. The diseases thus induced make up a formidable list, which, moreover, grows in length almost every year. Vegetable parasites, including, as they do, all the bacteria, are responsible for diseases of all grades of severity, from typhoid to ringworm. Animal parasites—more important in tropical climates than here—are the cause for, among other diseases, syphilis, malaria, pediculosis, and the itch.

From the foregoing survey, which, though wide, by no

means covers every part of the field, it will be seen that, in seeking the cause of a patient's ill-health, we have to give heed to very many factors. It is not enough, even in these days of bacteriology and other medical sciences, to suspect a germ, or to make a chemical analysis of the patient's secretions, or even to investigate his dietary. We must, in addition, closely scrutinize his daily life both at home and at his work, his worries and ambitions, the pressure of social conventions on his personal inclinations, even such seemingly trivial items as tobacco-smoking or tea-drinking. In a word, the physician, if he is to lay his finger on the root-causes of the diseases which come before him, requires to esteem nothing too small for his careful investigation, and yet at the same time to take a broad, comprehensive view of all the circumstances of each case.

CHAPTER III

HOW DISEASES ARE DESCRIBED

By thus emphasizing the importance of the starting-point of a disease, I wish to indicate that, in any given case, the first and foremost necessity is to trace, if possible, all the symptoms to one common origin. Until this has been done we are faced with considerable difficulty, for, without knowing the cause, how are we to name the disease, and, still more, how are we to adopt the proper treatment? In point of fact, of course, the aim of modern medical research is to study every disease in such a way as to discover its cause. As soon as this is known the prevention and the treatment become relatively simple. On the other hand, by the time a patient first seeks medical advice, the cause of his illness is often masked by its effects, which have themselves been the starting-point of secondary effects; so that the case is already complicated, and the primary cause of the whole trouble can perhaps be found only with difficulty. Not infrequently, indeed, the more obscure cases require patient observation extending over some considerable time. However, in order to make the task as easy as possible, it is the custom of medical writers to take each disease in turn, and to set out in order all the facts that are known about it—what circumstances favour its development, how it begins, its symptoms, how long a course it runs, how it varies in different people, how it is to be known from other diseases,

and so on. In this way we obtain a life-history, or biography if you like, of every disease, so that with any given patient our task is to decide which of these descriptions tallies best with his condition. Moreover, these life-histories are always planned on the same lines, the different points in connection with the disease being collected under some half-dozen recognized headings.

We begin with what is called the **Ætiology** of the disease. This includes all those factors and circumstances which influence its occurrence. Thus, such matters as age, sex, time of year, climate, diet, exercise, occupation, social position, habits of life, are included in the ætiology. Further, it is usual to divide these ætiological factors into two classes—*predisposing* causes, which, without being responsible for setting up the disease, render the patient to some extent liable to an attack, and *exciting* causes, which have a more direct influence. By way of illustration, let us take the ætiology of apoplexy (the condition in which a bloodvessel bursts in the brain). We find that apoplexy is commoner in men than in women, that the men are usually past middle age, and that most often they are already suffering from Bright's disease. These, then, are the predisposing causes; in other words, we judge that any man past middle age and with Bright's disease is predisposed to apoplexy. Then again, we find that apoplexy practically never occurs during sleep, but is specially liable to develop at the moment a patient is exerting himself physically or is excited—lifting a heavy weight or making an after-dinner speech. These, therefore, are exciting causes of apoplexy.

The next heading in the description is the **Pathology** of the disease. Briefly stated, this is an account of the diseased processes which are set in train by the cause of the disease. Thus, in epilepsy, the pathology refers the epileptic seizures to a disturbance of nerve cells at a certain

part of the surface of the brain. In support of this explanation we are told that the attacks often come on after an injury to the head, that they are accompanied by a loss of consciousness, and that sometimes they are associated with psychological disturbances such as a loss of moral control—three facts that clearly point to the brain as the site of the disease. Further, it is known that if a certain part of the surface of the brain is pressed on by a tumour, or even if it be irritated by a mild electrical shock, a convulsion very similar to an epileptic fit may follow. Therefore, it is argued, epilepsy is not only a disease of the brain, but is a disease of this particular part of its surface. Generally speaking, we may say that the pathology of a disease is the explanation (based on theory, on experiments, and on bedside observations) which best accounts for all the facts that are known about the disease.

Closely related to its pathology is the **Morbid Anatomy** of a disease. This describes the anatomy of the patient in so far as it has been changed from the normal by the morbid influence of the disease. Of course, since functional diseases are not associated with any anatomical changes only organic diseases call for an account of their morbid anatomy. With them—for example, a gastric ulcer—the account would include all the changes that might be seen in the post-mortem room—the ulcer itself eating a hole through the stomach, perhaps an abscess that has developed in that neighbourhood, general peritonitis, possibly even pneumonia and empyema.

Having now, by the help of ætiology and pathology, learned a good deal about the nature of the disease, we must next go to the bedside to study it in the living subject —*i.e.*, we must investigate its **Symptoms**. In doing this, however, it will at once be seen that, while we can detect some of the symptoms for ourselves (delirium, for instance, or vomited blood), we can know others (such as a headache or a feeling of sickness) only from what the patient tells us.

We have, therefore, two classes of symptoms—*objective*, if they lie within our own observation; *subjective*, if they exist only in the patient's consciousness. The former will be discovered by a careful investigation of the case; but, on the other hand, no amount of examination is likely to tell us what the patient feels. In order, therefore, to elicit all the symptoms, we must depend, in part at any rate, on the patient; and if he be stupid, or wandering in mind, or unconscious, we may find difficulty in solving the case. With little children, of course, who in no circumstances can help by telling what they feel, we are compelled to rest satisfied with objective symptoms alone.

Over and above symptoms, however, the physician relies on what are called **Physical Signs**—*i.e.*, the numerous little indications of disease which he is able to detect on minutely examining the patient's organs. Many of these signs can be discovered with the unaided eyes or fingers—a rash on the skin, or a tumour in the abdomen—but for others we need the help of special instruments and methods of examination, such as a stethoscope, ophthalmoscope, X-ray apparatus. These more precise scientific aids, which every year grow more elaborate and searching, have put into the hands of the modern physician a means of recognizing diseases even in their earliest stages, when probably an ordinary examination would detect nothing amiss.

So soon as the symptoms and physical signs have been noted we reach the most important question of all—namely, What disease do these symptoms and signs represent? The next heading, therefore, in our account is **Diagnosis**, or the identification of the disease. That this question deserves the chief place will be obvious if the matter be considered for a moment. True, our final aim and object is the treatment and cure of the disease, but how can the correct treatment be adopted (except by luck) if the diagnosis is erroneous? Indeed, accuracy of diagnosis is the pivot on which the whole question turns. On the other hand, diag-

nosis is not always easy. It calls for careful investigation of the case, experience, and a judicial weighing of the evidence. Unfortunately, it is not as though a disease always took the same form in all patients. On the contrary, different patients, though suffering from the same disease, may present dissimilar symptoms. Moreover, we often find that different diseases closely resemble each other in the main, and the distinction between them is to be established only on points of detail. As a matter of fact, with most diseases the diagnosis can be narrowed easily enough to a choice between two or three or four alternatives, but beyond this the ultimate decision may not be clear. Sometimes, indeed, the decision, for the time being at any rate, must be based on probability rather than on certainty. This problem of differentiating between closely related diseases is known as *differential diagnosis.* Just one point more. In contrast to these complicated diagnoses we find occasionally, but not often, that some symptom or sign is peculiar to one disease and one disease only. Such a symptom is spoken of as *pathognomonic;* it is, as it were, the trade-mark of the disease.

So far we have considered only those aspects of a disease which principally interest the physician. The patient's chief concern, however, lies in another direction. First, he will want to know how the disease will affect him—is it dangerous? will it leave any permanent injury behind? Secondly, he will ask what can be done to cure him.

Given such and such a disease, what has the future in store for the patient? Will he recover? If so, completely or partially? Will he be liable to another attack? If, on the other hand, the disease is fatal, how long has he to live? The answering of these questions makes up the subject of **Prognosis**, or foretelling what is going to happen. To be accurate in prognosis requires, in the first place, a familiar acquaintance with many other cases of the same disease, from which the probable course of any particular case can be surmised. Again, it is necessary to know whether the

disease is a *primary* disease or a *secondary* disease—*i.e.*, has it arisen in a previously healthy individual, or is it the secondary result of a pre-existing disease? For instance, a patient is found to have early tuberculosis of the lung, but, being otherwise healthy, the prognosis is good. On the other hand, a second patient with equally early phthisis is found to have, in addition, diabetes—a fact which materially darkens the outlook. Yet again, prognosis demands that all the side issues of a disease must be taken into account. What *complications* may arise from day to day—such, for example, as perforation in typhoid fever—and how will these complications affect the chances of recovery? Then again, what troubles may follow in the wake of the disease—*sequelæ*, as they are called—such as chronic heart disease after rheumatic fever?

Apart, however, from complications and sequelæ, the prognosis must pay heed to the patient himself—his age, temperament, constitution, past life, etc. A man, let us say, is in an early stage of pneumonia, and the chances of his recovery seem rosy enough; but on making inquiry, we learn that for years he has been a heavy drinker. Immediately the prognosis becomes bad, for we know that alcoholic patients go down before pneumonia like ninepins. Finally, it is usual to distinguish between the immediate prognosis and the remote prognosis—that is to say, between the outlook for a few days ahead and for the more distant future. In apoplexy, for example, the immediate risk to life, if the symptoms are not severe, may not be great; and yet, at the same time, the future outlook may be bad not only because the patient is likely to be permanently paralyzed, but also because in all probability he will suffer a second and severer attack, which may prove rapidly fatal.

The remaining particulars in the description of a disease are comprised under the heading of **Treatment**, to which important subject I shall devote the next chapter.

CHAPTER IV

ON TREATMENT

From the nursing point of view, this subject outweighs all the others in importance, inasmuch as a nurse's primary concern is in applying the necessary measures for relieving a patient from the effects of his disease. At the outset, therefore, it is desirable that she should have some knowledge of the general principles which guide a physician in selecting his line of treatment, and of the main classes of measures by which these principles are carried into effect.

Without doubt, the fundamental principle in a case of sickness is that Nature so leans her weight as to incline the course of every illness towards recovery, and not towards death. In other words, Nature is on the side of the physician, and not against him. Moreover, since Nature is a mightier force than any he can wield, the physician is only prudent who abstains from any interference with the course of the natural cure. And yet, on the other hand, experience soon shows that Nature is often slow, roundabout, tedious, even stupid in her ways, and on such occasions the physician, alertly on the watch and quick to recognize her difficulty, will come forward with his science and his art to disentangle her from her embarrassment. Broadly speaking, therefore, successful treatment requires a thorough knowledge of the natural road towards recovery, in order that the way may be made smooth and

every obstacle cleared away; and it demands also, if complications are to be prevented, an equally intimate acquaintance with all the side-turnings down which a case may wander into danger.

Now, by a careful investigation and study of any case that comes under observation, it is possible to recognize various facts and circumstances which suggest or indicate the broad lines of the treatment. These are spoken of as the *indications for treatment*. Thus, with a patient who has recently vomited blood, the first indication is obviously to stem any further hæmorrhage. Or, with a patient suffering from chronic bronchitis, the indications are first to remove any cause of irritation to the bronchial tubes, next to promote the expulsion of phlegm from the lungs, then to allay the cough. Such indications require to be sought over a wide field. Sometimes they are to be found in the ætiology of the disease—as with lead colic occurring in a house-painter; at other times in the pathology—as that epidemic diarrhœa, by draining an infant's tissues of its fluid, is best treated by saline infusions; or in the symptoms themselves —for example, the insomnia of heart disease, that calls for a sleeping-draught.

These indications are the sign-posts that point the direction which the treatment should follow, without, however, necessarily telling us what particular practical method should be adopted. In the case of chronic bronchitis, for example, one of the indications, as we saw, is to allay the cough; but whether by internal medicines, by inhalations, by liniments to the chest, by modifying the diet, or even by ordering the patient off to Egypt, still remains to be decided. So soon, therefore, as a case has been sufficiently studied to yield its indications, the next step is to translate them into practical measures. As may be imagined, this opens up a very wide choice indeed, since it includes a thousand and one remedies, from prescribing a dose of salts

to advising a patient to turn to a new occupation. We shall do best, therefore, to take a bird's-eye view of these measures, arranging them according to groups—some half-dozen in all.

First come the measures of **Preventive Treatment**, or "prophylaxis," as it is called, which include all those steps necessary to escape disease and to retain health—that is to say, the problems of public health and personal hygiene. But, important though these are, they need not detain us here, for the reason that sick-nursing implies patients whose prophylactic measures have already failed, and their disease can obviously no longer be avoided. On the other hand, the measures for the prevention of a recurrence of the disease, either in the same patient or another, are plainly of very direct interest to a nurse, seeing that they may involve important nursing details, especially in connection with infectious cases.

Next come the measures for the general **Hygienic Treatment** of the case. These comprise such fundamental considerations as to whether the patient must keep his bed or be allowed to get about; what kind of mattress, bed-clothes, night garments, are desirable; the temperature of his bedroom, its ventilation, sunlight, etc.; whether visitors, conversation, or letters are to be permitted; the amount of rest, sleep, and exercise; and so on.

Then, having settled these matters, we come to the **Dietetic Treatment**. Here we have to consider both what foods must be withheld and what taken. With the latter, again, we have to advise as to the form in which they should be taken—with milk, for example, whether plain, diluted, peptonized, etc.; the quantities of the various kinds of foods; and, finally, the frequency of the feeds or meals.

The fourth division is the **Medicinal Treatment**. This includes both external treatment—to a rheumatic joint, for instance—and internal treatment by means of drugs. So

far as the former is concerned, the choice of remedies is very wide. It will be enough, by way of illustration, to mention poultices, blisters, liniments and ointments, paints, gargles, sprays, inhalations, massage, electricity, X-rays, water-baths, air-baths—in fact, all our resources for the external application of heat, cold, drugs, etc. The other branch of medicinal treatment—the internal administration of drugs—is of special interest to a nurse, on whom commonly falls the duty of administering whatever drugs are ordered. She will therefore wish to know why this or that drug has been prescribed, what its actions will be, what result it is expected to attain. These questions, together with that of the methods of administering drugs, I propose to reserve for fuller discussion.

The next group is the **Climatic Treatment** of the case—*i.e.*, treatment by residence at health resorts, etc. Here again, since trained nurses are so often called on to accompany patients abroad or to spas, it will be of service to them to know something of the medical aspects of climates and of spa treatments or "cures." To this end I shall allot a few pages to this subject later on.

Finally, we must not overlook the **Psychical Treatment** of a case. I have earlier insisted on the importance of the mental factor in medical conditions, and we must now allow it a corresponding importance in treatment. Of course, in most cases psychical methods are employed to some extent at any rate, but in others they fill the chief place, the physician then relying mainly, if not exclusively, on mental and moral influences to restore the patient to health.

These, then, are the main groups into which all medical treatment falls. Before concluding the subject, however, I want you to consider one or two further points. As a rule the medical textbooks, under the heading of each disease, describe the treatment appropriate to that disease—a custom which unfortunately fosters the belief that it is

the disease as described that is to be treated, and not the patient; whereas, of course, so one-sided a view could produce results that are only partially satisfactory. When we remember that no two individuals react in quite the same way to one and the same cause of a disease, and that often, indeed, the differences are very marked, we cannot fail to realize the objections to the identical treatment of all cases of any one disease; and, in point of fact, a method of treatment that has proved successful in one case may signally fail in another. This being so, it is necessary to remember that not the disease alone, but rather the patient who is diseased, must be the objective of the treatment. In other words (adopting our definition of a disease as a disturbance of the bodily functions), we must treat each particular disturbance as it occurs in each particular patient, and must follow no cut-and-dried method, which, however appropriate on the whole to an average case of the disease, is perhaps suited in all its details to no case in particular.

Consider for a moment some of the varying factors that must be taken into account. To begin with a simple instance. We know that some methods of treatment such as gargling are appropriate to adults, but inapplicable to young children. Again, the question of sex must be allowed for. Men, as a rule, dislike any method of treatment that confines them to bed; in fact, if their normal activity is interfered with, they are apt to chafe under the restraint, to begin to question the efficacy of the measure, even to throw it aside as not worth the candle. Women, on the other hand, made more familiar with ill-health by the exigencies of their sex, better appreciate the value of remedial measures, even if they bring only future benefit; they are more tolerant of prolonged and systematic treatment, and altogether make better patients.

Yet again, over and above considerations of age and sex, the individuality of the patient himself or herself must never

be overlooked. A nervous, highly strung young woman is hardly likely to be benefited by the identical measures that would suffice to cure her stolid, matter-of-fact sister. Further, even the patient's relatives may be a reason for modifying the treatment. For example, if they worry him or retard his recovery, it may be necessary, on this account alone, to enjoin a partial or complete isolation of the patient, possibly his removal to a nursing-home or institution.

Taken altogether, therefore, successful medical treatment is a complex subject calling not only for medical skill, but for an understanding of human nature, and a real but unexaggerated sympathy with the patient. Once the line of treatment has been started, its effect, of course, must be closely watched and its details revised, if necessary, from time to time. Even if good results are not at once apparent, it may still be right to persevere on the same lines; though, on the other hand, if the treatment has been given a fair trial, but without success, it may be advisable to withdraw it altogether, and substitute fresh methods.

Finally, since the treatment depends essentially on the diagnosis, it may be asked what is to be done with those cases in which the diagnosis is obscure, or, perhaps, cannot be made until relatively late. Here, of course, if the future developments of the case are uncertain, no complete plan of treatment can be thought out beforehand, and it becomes necessary to adopt what is known as "expectant" treatment—that is to say, the weekly, daily, even hourly progress of the case is closely watched and each difficulty dealt with as it arises. In these circumstances, with the patient moving, as it were, along a river that is enveloped in mist, it is sufficient to pilot him clear of each obstacle as it looms into sight, steering him safely in and out of the rocks and shoals. Later, when the mist has blown away, it will be time enough to lay a straight course for recovery.

CHAPTER V

DRUGS AND PRESCRIPTIONS

In order to give a fair idea of the part played by drugs in modern treatment, it will be necessary to emphasize not only the importance of this branch of therapeutics, but also its undeniable limitations in the light of present-day medical knowledge. Every doctor will admit that the significance attached by the laity to a bottle of medicine often reflects more credit on their faith than their understanding, and if the choice were left to them as between medicine and medical advice, the druggists, at any rate, would still do a good business. And yet, in thus showing their preference, they would, in a very large number of cases, be rejecting the substance for the shadow. But, no doubt, before this erroneous belief, which stretches its roots through many centuries, can be eradicated, the laity will need to be much better informed on matters of health.

Perhaps we can best appreciate the gradual change in drug treatment from complexity to simplicity by following its history from earlier days. Without, however, spending too much time on this point, I will content myself with a single illustration which fairly exemplifies the general trend. Let us take a well-known remedy for diarrhœa, familiar to every nurse—namely, the aromatic chalk powder (Pulv. cretæ aromat.) of our official Pharmacopœia. At the present time its only ingredient, apart from sugar and flavouring,

is ordinary prepared chalk. As it happens, however, it dates from Queen Elizabeth's reign, when it was invented by none other than Sir Walter Raleigh, in his enforced leisure as a prisoner in the Tower, and it speedily became widely used under the name of "Raleigh's Great Cordial." The recipe included some fifty ingredients, prominent among them being crushed pearls and coral (*i.e.*, forms of chalk), viper's flesh, and other mysterious remedies. A century later, being still in high repute, it was admitted, somewhat simplified, into the Pharmacopœia of the College of Physicians under the name of "Confectio Raleighana." In the Pharmacopœia of 1746 it was further simplified, powdered crab-shells (chalk again) being substituted for the pearls, and in 1788 its name was altered to "Confectio aromatica." Finally, after being further deprived of useless ingredients, the crab-shells, in 1851, gave place to ordinary prepared chalk, and at the present day "Raleigh's Great Cordial" survives as Pulv. cretæ aromat.

The steady tendency towards simplification shown by this example is typical of drug treatment as a whole. Large numbers of drugs have been cast aside as useless, and to-day, instead of writing a prescription with ten, fifteen, or twenty ingredients, we prefer to select one or, perhaps, two drugs of known and proved efficacy. At the same time, however, as our prescriptions have become more scientific, our reliance on drugs of admitted worth has increased. In fact, though a modern physician reposes nothing like as much faith in the omnipotence of drugs as was customary in the past, yet, when he does write a prescription, it is in full confidence both of its efficacy and the limits of its efficacy.

In these circumstances it may be asked what tests are required before a drug can gain acceptance as of real value? First we rely on what is called its **Physiological Action**, as proved by experiment. The drug is administered to some

animal, and its effects narrowly studied by the physiologist. Take, for example, digitalis—the purple foxglove. The physiologist prepares an insensible animal so that its heart, connected to a light lever, traces on prepared paper a record of its beats. He then, at a noted moment, floods the little bloodvessels in the heart with a weak solution containing the active chemical principle extracted from the digitalis leaves. Immediately he sees the heart respond by beating more vigorously, more slowly, and, if it was irregular before, at a steady pace. Moreover, the same physiological effects can be observed in human beings. If, therefore, we have a patient with heart disease, whose heart is beating feebly, quickly, and irregularly, digitalis is the very drug to quieten and control it.

Apart from physiological experiment, however, it is sometimes enough to rely on our clinical experience of the effects of a drug in cases of this or that disease, even though we are not able to say how the effects are produced. For instance, a patient having had syphilis, develops a gummatous tumour in the liver. We give him iodide of potassium, and the tumour is rapidly absorbed. Just how the iodide acts we do not know, but, nevertheless, this clinical evidence is sufficiently conclusive.

Of course, quite apart from any question of direct physiological action, we must admit a certain psychical influence that medicine may exert. Thus it is a fact, established over and over again, that patients suffering from some affection for which we have no drug remedy will often make a quicker and more complete recovery provided they have this tangible symbol of their cure constantly before them. Indeed, with some a successful result is hardly possible without this help, however physiologically inert the drug prescribed. Once again we recognize in this the influence of mind on body—an influence which the physician is not at liberty to ignore, but is bound to turn to the best interests of his patient.

Dosage.

Suppose, then, a particlar drug has been selected for administration. The next question is, In what dose shall it be prescribed? Here many things must be taken into account. In the first place, the dose must be adjusted to the size of the individual—so many grains of the drug to so many pounds of patient, as it were. In practice, however, this method, though customary in experiments with animals, is hardly applicable in the consulting-room. Instead, we accept the patient's age as a rough index of his size. Children, for example, obviously could not tolerate the doses necessary to adults, and it has been found by experience that the dose appropriate to any given age can be calculated very readily with the help of a simple formula. The child's age is divided by its age plus twelve $\left(\frac{\text{age}}{\text{age} + \text{twelve}}\right)$. Thus, for a child of six the dose is $\frac{6}{6 + 12}$, or one-third the adult dose.

Then, again, there is the important question of the personal idiosyncrasy of the patient. This is a factor that can be measured only by trial. Some patients, for instance, develop poisonous symptoms after even moderate doses of salicylates; others break out into a rash with quite small doses of bromide. In fact, there is a long list of drugs well known to produce, now and again, objectionable, even alarming, effects, although given in ordinary doses. Yet a third factor is the condition of the patient at the time the drug is administered. Thus it is recognized that the severer the pain, the larger the dose of opium needed to give relief.

Nevertheless, in spite of allowance being made for these factors, perplexing cases occur not infrequently when a patient either does not respond to a drug as was expected, or responds at one time but not another. For a long time

the explanation of this was sought in the personal equation—the idiosyncrasy of the patient. But more recently suspicion began to fall on the varying quality of drug employed. Was it possible that this, as placed on the market, adhered to no standard, but was stronger in some samples than others? This suspicion has been confirmed beyond doubt. Take the drug that was mentioned earlier—digitalis. Tested physiologically, some preparations of digitalis were found to be notably below standard. The fault lay not with manufacturer, but with the foxglove itself, the leaves of which are found to contain an inconstant quantity of digitalin—the result, perhaps, of variation in the soil from which the plant draws its sap, perhaps of the amount of sunshine bathing its growing leaves. Whatever the exact cause, however, we are coming now to recognize that it is not enough to dispense anything that is labelled "tincture of digitalis"; we must first assure ourselves of its potency. To this end, the practice of "standardizing" drugs before they are sold is becoming customary. But, failing this, we can in several instances prescribe the active chemical ingredient of the preparation—for example, digitalin.

Prescribing.

Another important question is the method of administering a drug. Shall it be given by the mouth, by the skin, by inhalation into the lungs, by contact with a mucous membrane such as that of the rectum or vagina? Shall we select the more rapid method of hypodermic injection into the tissues beneath the skin, or, quicker still, injection into a vein? These are the available routes, and, of course, the choice will be made partly according to the nature of the case, partly according to the desired effect of the administration. Moreover, according to the choice so will the drug be prescribed. Thus, if the skin is selected, we should

probably mix the drug with fat, which, by adhering to the skin, provides the opportunity for absorption to take place; in other words, we make use of an ointment. Most often, however, the drug is given by the mouth, either dissolved in water or spirit, or made into a pill, a powder, or a confection.

As to the **Prescription** itself, each item will be found to owe its place, not to any haphazard selection, but as embodying the underlying principle that holds the whole prescription together. To make this clear, let me conclude by examining the following prescription for a case of epilepsy:

℞	Bromide of potassium	gr. xv.
	Solution of arsenic	♏ii.
	Liquid extract of liquorice	♏lx.
	Chloroform-water	to ℥i.

The first line gives the name and dose of the selected drug. This potassium bromide, however, in addition to its soothing effect on the brain, may produce, as we have already seen, an eruption. To obviate this, we therefore add a small dose of arsenic. Next, since it is desirable to cover the brackish taste of the bromide, and perhaps to colour the medicine to avoid accidents, the dark brown liquid extract of liquorice is put in. Finally, the prescription concludes with the name and amount of the fluid needed as a "vehicle" to make up the dose to 1 ounce.

CHAPTER VI

DIET AND DIETS

It will be remembered that dietetic treatment was one of the principal groups into which we divided medical treatment generally. It will hardly be necessary, however, to devote any space to the physiology of diet in health, or to the composition of foods; our interest lies rather in diet in sickness. This much physiology, however, I may recall to your minds—namely, that the amount of nourishment required by any normal individual is utilized inside the system for two different purposes. The greater part goes to produce animal heat—*i.e.*, to keep the body at a normal temperature, however cold the external atmosphere may be. The balance is needed to produce muscular and mental energy, and thus to make good the wear and tear of the body. In a child, moreover, a further supply of nourishment is necessary to subserve the requirements of growth. At all ages, however, any excess of food that is absorbed into the system over and above these amounts is physiologically superfluous, and, instead of being used up in the tissues, may be deposited and stored up as fat.

The requirements of a person who is ill, on the other hand, may be materially different, especially in acute illness. The patient, now confined to bed, expends comparatively little muscular or mental energy, and, in place of losing large quantities of animal heat into the surrounding air, is

protected by the bedclothes. For these two reasons, then, he can keep all his wants supplied on a much smaller quantity of nourishment than if he were up and about. In fact, an adult man, in these circumstances, can be satisfied with three or four pints of milk a day—an allowance which would be quite inadequate if he were doing work, especially on a cold day. Our first conclusion, therefore, is that patients confined to bed do not need as liberal a dietary as in health. And, we may add, if too much is forced upon them, harm and not good may result.

Next let us understand what kinds of invalid nourishment are suitable, what unsuitable. In the first place, the patient should be spared, as far as possible, the muscular effort needed in chewing and digesting solid food. Further, since in acute illness the mouth is dry and the saliva deficient, the patient would have mechanical difficulty in chewing and swallowing solid food. Consequently, the first consideration is to supply the food, mainly at any rate, in a liquid form. On the other hand, an exclusively liquid diet brings in its wake a danger of its own, the importance of which has been recognized only in recent years. With no hard food to be masticated and turned from side to side in the mouth, the interior of the mouth no longer gets its natural cleaning: the tongue becomes furred, the teeth and gums covered in an accumulation of fermenting acid food. If this is neglected, the frequent result is sepsis of the mouth, possibly spreading along the salivary ducts, and producing inflammation of the salivary glands. To avoid these serious defects the nurse, of course, endeavours to keep the inside of the mouth scrupulously clean. As a further safeguard, however, it is advisable to allow, especially in cases of prolonged fever, some hard food to be chewed at least once every day, by which means the mouth and teeth are scraped clean.

Bearing this caution in our minds, we can now consider

the most suitable forms of liquid food. Soups, beef-tea, and other meat preparations are not to be relied on alone, first, because (contrary to the widespread belief) their nourishing value is not high ; second, because they are apt to set up diarrhœa ; and, third, because, in acute illness, protein foods are not enough—carbohydrates and fat are also required. The ideal natural food which contains all these classes of foodstuffs and, at the same time, is liquid, is, of course, milk. Milk, therefore, is our stand-by, and the basis of the feeding. The drawback to its use, however, is that, for its bulk, it contains no great quantity of nourishment—nearly 9 parts in 10 are water. This may be a serious matter for a patient whose stomach is unable to retain any but small feeds, and therefore we reach our next important point—namely, that if milk alone is not sufficient, we should strengthen it by dissolving in it some additional nourishment (arrowroot, cornflour, etc.) which, without increasing the bulk of the feed, materially adds to its nutritive value.

In other cases, on the other hand, the patient—his tissues demanding not nourishment so much as water—may find that if his thirst is satisfied with milk, he will be overfed, and will vomit, or, at any rate, feel averse from his milk. In these circumstances, the milk should be diluted with a non-nourishing fluid, particularly plain water, or we can allow drinks of water, lemonade, Imperial drink, etc., apart from the regular feeds. In other words, we have to remember that a liquid diet is both food and drink, and that at any time it may be necessary either to strengthen or to dilute it. This is a point which must be carefully considered day by day, whatever the nature of the acute illness.

When dealing with diseases other than acute, the question of diet is often of subsidiary importance. For example, in valvular disease of the heart, chronic bronchitis, locomotor ataxy, to give a few instances, feeding makes no great difference one way or the other. On the other hand, in a

few diseases the relation is otherwise. Thus, with rickets the dietetic treatment is all-important. The same holds for infantile scurvy—a disease resulting from too rigorously sterilizing an infant's feeds. Again, with diabetes and gout, diet holds an important place which I shall refer to when dealing with these affections.

It is, however, in connection with diseases of the stomach and intestines that the diet is particularly important. Obviously, if we have a patient with, say, a gastric ulcer or inflammation of the large intestine, the question as to what foods we allow to pass along the stomach and intestines becomes of primary importance. In all such conditions we have to consider the special circumstances of the affection, and adapt our feeding accordingly. For example, if the stomach is at fault, we should avoid all foods which, digested only with difficulty, throw unnecessary work on the stomach, or which, in their high flavouring or chemical ingredients, contain material which might irritate the sensitive interior of the stomach. Similarly, if the large bowel is diseased, as by colitis, we should select foods which, leaving no undigested residue, would be so completely absorbed in the small intestine as to leave little or nothing to reach the colon. On the other hand, if the large bowel is inert, producing constipation, we should take care to arrange a dietary of those articles which, containing much indigestible material, would pass into the colon in quantity, and so stimulate its sluggishness.

In yet two other respects diet is important. In this world of discontent some people who are fat want to be thin, and others who are thin wish to grow fat. Both classes can be materially assisted by a judiciously planned system of dieting. If the case is one of obesity, it is necessary first to restrict the consumption of food, for most obese patients eat more than is required for animal heat and bodily wear and tear. Second, it is necessary to restrict

more particularly the starchy, sugary, and fatty foods; meat, however, does not share the blame for the obesity. These principles are applied in the **Banting System** of treating obesity, first introduced fifty years ago by William Banting, who himself grew so fat that at last he had to come downstairs backwards. The Banting diet consists of —(1) A breakfast of ¼ pound of lean meat, a cup of tea, and a little biscuit; (2) a dinner of lean meat or fish, vegetables, but no potatoes, a little toast, and some fruit; (3) a tea of fruit, a rusk and a cup of tea; and (4) a supper of fish or lean meat. Several other special obesity diets have been recommended by, among others, Oertel and Von Noorden, but space does not allow of their description here. Each of them, however, rigorously curtails the total amount of ood consumed.

In contrast to the above, the dietaries for the thin are planned on generous lines, and include plenty of fatty and starchy foods. They are, of course, much more widely applicable than obesity diets, since they are needed during the convalescence from acute illness and in chronic wasting diseases such as consumption. The same line of feeding, or rather overfeeding, is an essential part of the Weir-Mitchell rest-cure.

Finally, there are certain dietetic "cures," most of which are well known to the laity. On this account a private nurse is sure, sooner or later, to be asked about them, and, in order that she may not be at a disadvantage by not having the facts at her command, I shall conclude with a brief summary of half a dozen of the best-known of these "cures."

The **Tuffnell Diet** is intended for cases of aneurism. By rigidly restricting the amount of fluid, it is supposed to alter the composition of the blood, and thus to facilitate the natural cure of the aneurism by clotting. Tuffnell allowed only 4 ounces of milk or claret daily, with ¼ pound of

bread-and-butter, and 2 to 3 ounces of meat—a Spartan treatment which not everyone can endure, even in bed.

The **Salisbury Cure** for gout, dilated stomach, and certain skin affections, especially psoriasis, consists only of lean minced beef and hot water. The beef is taken in three meals, while, in between, a pint of hot water is slowly sipped.

The **Sour-Milk Cure**—less often heard of to-day than two or three years ago—owes its favourable introduction to Metchnikoff, who had been impressed by the longevity of the peasants in Bulgaria, where milk, soured by the agency of bacilli, is a staple food. These bacilli are able to change sugar-of-milk into lactic acid. The Bulgarian bacillus enjoys the reputation of a greater activity in this respect than any other lactic-acid bacillus, and, on this account, much has been made, even by the vendors of sour milk, of the nationality of their micro-organisms.

The **Salt-Free Diet**, introduced some five years ago by Widal, aims at the reduction of dropsy in Bright's disease by restricting the daily consumption of salt. It is supposed that the deficiency of salt in the blood, which necessarily occurs when the quantity in the food is restricted, promotes a demand for the salt that is normally present in dropsical fluids. In this way it is believed that the dropsical effusions are reabsorbed, along with their salt, into the circulation.

The Purin-Free Diet.—Purins are the class of chemical bodies to which uric acid belongs; and a purin-free diet has been employed for the relief of gout and gouty manifestations. These purins are contained in all meats, some fish, coffee and tea, and malt liquors. On the other hand, they are entirely absent from milk, cheese, butter, eggs, sugar, white bread, rice, and some vegetables. The purin-free diet consists mainly, therefore, of eggs, milk, cheese, and vegetables.

CHAPTER VII

CLIMATIC TREATMENT AND HEALTH RESORTS

A TRAINED nurse called on to accompany an invalid to a health resort has special responsibilities which may be a source of real anxiety. In the first place, being far from the patient's doctor, she may have to shoulder the responsibility in any sudden emergency or in any matter affecting the patient's general welfare. Of course, if an English-speaking doctor happens to be available, so much the better; but in most places abroad only foreign practitioners are to be found, and if the nurse is an indifferent linguist, this help may be of limited value. Then, again, the fact of being in new climatic surroundings implies certain risks; for, as we all know, people are apt to be taken ill while on holiday, and, whatever the exciting cause, it is difficult not to believe that the mere change in climate may exercise a predisposing influence to illness.

In order that a nurse may better understand the special difficulties and responsibilities with these cases, it is necessary to deal with the medical questions that arise in connection with climate and health resorts. To begin with, it need hardly be pointed out that not all health resorts are suitable for all diseases. In fact, a locality which possesses a deserved reputation in the treatment of a certain class of affections may be actually injurious to another class. This difference is to be explained by local conditions, which will

be borne in mind by the medical man when selecting a suitable resort for his patient. The temperature, for example, of the place is of very great importance—not merely the average temperature throughout the year, but the variations in the twenty-four hours. Some places, such as Egypt, are notable for a very wide daily range, amounting to as much as 30 degrees or more, and this may prove very trying to some constitutions. At other places, on the other hand, particularly small islands, the temperature is kept equable by the influence of the surrounding sea. It will be obvious that with patients suffering from, let us say, lung affections, any rapid changes in the temperature of the air breathed into the lungs would be likely to exercise a harmful effect; and, *per contra*, a mild, equable temperature would probably suit these cases admirably. Again, with regard to the humidity of the air—*i.e.*, the degree of dampness—a moist neighbourhood is not only enervating to many, but, so far as rheumatic cases are concerned, may aggravate the symptoms. Finally, the question of prevalent winds is very important; in fact, in many quarters of the world the medical value of the climate is completely destroyed at certain seasons on account of some periodic wind, like the Transmontana in Italy.

All these are points that a doctor considers when advising a patient to travel, and therefore are matters that a travelling nurse should take into consideration when judging the effects, favourable or the reverse, of a locality on her patient. Not only this, however, but she should make it her business, so soon as she has come with her patient to any new neighbourhood, to ascertain any local peculiarities which might be harmful to her case, and from which she must protect him. For instance, numbers of English nurses go abroad every winter with patients to the Riviera, which, with its reputation for sunshine and flowers, would seem an ideal place where convalescents might be left to

enjoy their surroundings without let or hindrance. And yet, as a matter of fact, the Riviera climate possesses two characteristics which, if not guarded against, are likely to do harm to the unwary patient. In the first place, there is a notable difference in the atmospheric temperature in the sun and in the shade, and a delicate patient, dressed perhaps in light summer garments, who is permitted, after basking in the sun, to rest in the shade, may very easily get chilled. Again, as soon as the sun sets, the temperature falls rapidly, and the genial, spring-like afternoon is quickly replaced by a cold evening. Unless the nurse is apprised of this fact beforehand, she would hardly be prepared to take the necessary precaution of getting her patient safely indoors while the sun is still high and warm.

Apart, however, from these strictly local peculiarities, the climatic conditions of all health resorts are usually classified, according to the proximity of the sea, into (1) marine climates, and (2) inland climates.

A **Marine Climate** pure and simple is, of course, to be found only in the open ocean, and is to be obtained only by sending the patient on a sea voyage. Its special features are an equable temperature, a certain degree of humidity, and a particularly pure, ozonized air. For this reason it is suitable in the treatment of various chronic but mild lung cases, and of patients recovering from a severe, exhausting disease, such as typhoid fever. Moreover, the very monotony of ship life, with its freedom from excitement, makes it appropriate to certain cases of nervous breakdown, in which the patient's energy has drained low and requires a long period of quiet and rest to be replenished. On the other hand, to recommend a sea voyage to a nervous patient with any but a slight degree of mental depression may lead—indeed, has led—to regrettable results, for, with the ever-present temptation of the sea all around, the patient may find suicidal impulses grow upon him.

Another variety of marine climate is that found near coasts and on small islands. Here the equable temperature, not only all the year round, but throughout each day, the freedom from dust, and the never-failing freshness of the air resulting from the alternating land breezes and sea breezes, mark out the *coastal climate* as appropriate for practically all cases of lung disease, especially tubercle, bronchitis, and emphysema. Moreover, delicate children of all kinds, and many cases of nervous exhaustion, are likely to derive benefit from this seaside atmosphere. On the other hand, skin cases are more than likely to be aggravated by a brine-laden atmosphere, and, perhaps on the same account, asthmatic patients do not often tolerate sea air at all well.

The names of the principal seaside health resorts hardly need be detailed, at any rate, so far as England is concerned, though here, of course, it is necessary to remember that many seaside places, suitable enough in summer, are to be avoided in winter. Still, in some, the winter climate is, in its way, as good, even better, than the summer climate —as, for example, Ventnor, Bournemouth, Sidmouth, and the south Cornish coast. Abroad we have the various islands off the Atlantic coast of Africa—Madeira, Teneriffe, Canary, the Azores; the Mediterranean littoral, including the Italian Riviera—Hyères, Cannes, Nice, Mentone, San Remo, etc.; while farther north is the delightful Biarritz, with its neighbouring villages, including St. Jean de Luz.

Coming now to the second main class of climates—the **Inland Climate**—we divide these medically, according to their elevation above sea-level, into (*a*) mountainous, and (*b*) lowland. The *mountainous* or elevated climate is one that has been more particularly studied in recent years in relation to the treatment of pulmonary tuberculosis at high altitudes, though it has also received a good deal of attention on account of the distressing "mountain-sickness"

which lies in wait for those venturing too far above the clouds.

Mountain air is dry, cold, and, for the most part, still (*i.e.*, free from winds) — three conditions which unite to confer on it a peculiarly stimulating property. Against this must be set, however, the fact that mountain air is rarefied — contains less oxygen than in a corresponding cubic space lower down towards sea-level. This rarefaction, which has the effect of diluting the air, as it were, throws a strain on the lungs, since, if the same amount of oxygen is to be inhaled, the breathing must be more rapid. Consequently, one of the first effects of a mountain climate is to make the patient short-winded, and thus to stimulate his breathing—a result which may or may not be desirable according to the nature of the complaint. Moreover, in company with the breathlessness go other symptoms, particularly a quickened beat of the heart—which is required to pump more vigorously in order to keep up the supply of oxygen to the tissues—headache, and listlessness. These symptoms, however, provided the climate is going to prove advantageous to the patient, should subside within a few days, and thereafter the brisk, exhilarating effect of the air makes itself felt, helped by the bright sunlight and the clear and cloudless sky that characterizes elevated regions.

From the foregoing it will be obvious that this elevated climate is the very last place to which one would send a patient who, with some chronic lung affection such as emphysema or bronchitis, is breathless even on the lowland. Similarly, heart cases venturing much higher than 2,500 feet above sea-level are likely to find their symptoms aggravated. In early cases of consumption, however, many doctors believe that, provided the altitude is not excessive, the stimulating effect of the air on the breathing is beneficial. And certainly the rapid increase in the number of sanatoriums in the Swiss Alps is evidence in favour

of the successful result of the high-altitude method of treatment. Indeed, so far as medical treatment is concerned, the Swiss Alps are practically monopolized with these cases. Fortunately, however, for other patients, we have choice of three or four other mountain regions, especially the Pyrenees—with such well-known spa-centres as Cauterets and Bagnères-de-Bigorre—the Black Forest, and the Harz Mountains.

Finally, there remain the *lowland* health stations. So far as climatic peculiarities are concerned, it is hardly possible to speak in general terms of these, since they present so many differences. Perhaps the most popular (and most fashionable) of these lowland regions at the present time is Egypt, which, with its singularly dry, sunny, desert air, proves of no little service in the treatment of rheumatic and gouty affections. Nearer home we may select, for mention, Pau, at the foot of the Pyrenees, with a peaceful, reposeful air which has earned for it a reputation in the treatment of insomnia; and Dax, between Bordeaux and Bayonne.

Spa Treatment.

This brief account would hardly be complete without some mention of the treatment carried out at many of these health stations. Very often, of course, the natural occurrence of some medicinal spring has been the starting-point in attracting patients. At these places the treatment, or **Cure**, as it is called, centres round the spring-water, which must be drunk in specified amounts and at stated hours—usually beginning before breakfast. Developing out of this simple regimen, we usually find bathing establishments where the water, heated either naturally or artificially, can be applied to the whole body, or, by douches, etc., to any affected region. These methods of external application are, at many of the foreign spas, very highly specialized, and

the patient submits himself to this or that method, or, more likely, follows a prescribed course. Still further developing the treatment, medical electrical apparatus is usually installed, while special baths—volcanic mud, needle, peat, hot-air, etc.—are also available. On these lines each spa elaborates its own special cure, and the visitors, usually placing themselves under a local doctor, pass from one stage to another until the whole cure has been completed. If this is thought not to be sufficient, the patient may then take an "after-cure," which usually means that he transfers himself to another spa, and here follows another course supplementing the first.

Whatever opinion may be held of the value of many of the proceedings insisted on at each spa, the beneficial results in many cases cannot be gainsaid. And a nurse who finds herself a little sceptical as to the genuine importance of some of these measures should remember that, though, for example, fango di Battaglia, carbonic acid baths, and many other items may not have a great deal apart from their novelty to commend them, nevertheless, these spa treatments, taken as a whole, by enforcing a regular and healthy daily life, free from excitement, strain, and excess, can restore the health of those whose maladies are functional. And even in organic diseases, such as rheumatism, though the treatment can hardly claim any specific curative power, it may do much to relieve the patient of his most trying symptoms.

CHAPTER VIII

DISEASES OF THE HEART AND BLOODVESSELS

So far I have dealt only broadly with medical diseases and their treatment. We can now begin, however, a more detailed study of individual diseases, and to open the series I have chosen the important group of affections that are included under the term "heart disease." First let me sketch, however, in a few words, the physiology of the heart. It must be remembered that this organ is essentially a muscle, and, like all muscles, its function is to do work as it contracts—in this instance to circulate the blood. To this end it consists of four separate sacs or chambers, arranged two and two—auricle and ventricle. Each is lined by a delicate membrane called the "endocardium," outside which lies a thick covering of muscle which, as it contracts, squeezes the endocardial sacs and empties them of blood. Moreover, to prevent any flow in the wrong direction, the openings of the ventricles are fitted with valves so constructed as to shut automatically the moment any blood tries to run back. Mechanically, therefore, the heart is a muscular pump driving blood along the arteries, through the capillaries, and back again along the veins—a task which, of course, uses up a good deal of energy, especially in forcing the blood through the narrower vessels.

To facilitate this work, by reducing friction, the heart lies in a fairly close-fitting bag—the pericardium—the inside

of which is smooth and lubricated with secretion. Further, the muscle itself is generously supplied with nourishment by the two coronary arteries; and, finally, the work of all four chambers is steadied and controlled by a specially contrived regulator as well as by nerves and nerve cells, some of which actually lie among the muscle fibres.

These, then, are the conditions in health. Now let us look at them in disease. Generally speaking, the work of the heart can be interfered with in one of two ways. Either the heart is itself diseased, and can no longer perform even its ordinary task; or, the heart being healthy, its task of driving blood through the narrower vessels is so increased as to overtax its powers, in which case the circulation is bound, sooner or later, to suffer. In neither instance, however, does the heart give in straight away. On the contrary, so soon as it finds its work becoming onerous, its first response is to become more muscular in order to cope with its difficulties—that is to say, it becomes bigger, heavier, more powerful, or, as it is called, it "hypertrophies." At the same time, its chambers tend to enlarge, and can now deal with more blood at each beat—that is, the heart "dilates." In this way, provided the overtax is only moderate, the hypertrophy and dilatation may be enough to compensate for the extra strain; no symptoms of heart disease will then develop, and we say the case is "compensated." Unfortunately, however, the original cause of the compensation becomes in most cases steadily worse—perhaps in the course of years—until the day comes when even compensation can do no more. The muscle can no longer contract properly, the circulation goes all to pieces, and henceforth the patient is numbered among the chronic "hearts" so familiar to us in the wards.

Let us consider what it is that makes compensation necessary.

1. Most often one of the valves ceases to work properly.

During the course of some fever, particularly rheumatic and scarlet, or of some local inflammation, such as vaginitis or colitis, or even a whitlow, the bacteria pass into the circulation and so gain the interior of the heart. Here they attack one of the valves, especially the mitral, producing an inflammation known as **Acute Endocarditis**. Within a few hours or days the edge of the valve is studded with little inflammatory growths or "vegetations," and the valve, no longer able to shut accurately, begins to leak. The blood regurgitates in the wrong direction, and we have the condition of mitral or aortic regurgitation, according to the valve affected. Later, however, these vegetations may become absorbed without any permanent damage remaining. But very often, instead of disappearing, they become hard and tough, the regurgitation persists, and the condition is then one of chronic endocarditis. At the same time, the erstwhile delicate valve thickens until it can no longer open freely, thus obstructing the flow of blood in the right direction. We then have mitral or aortic obstruction ("stenosis") as well as regurgitation.

2. In some cases even worse happens in the acute stage. The vegetations grow to a large size, sometimes as big as a grape, and perhaps spread over the lining of the heart (Fig. 1). Being infected with bacteria, they soon ulcerate, fragments break off, and, caught up in the blood-stream, are swept to distant parts of the body. Here, coming to an artery too narrow to pass through, they get stuck, and, plugging the vessel, stop the circulation and deprive a part at east of the organ of its nourishment. The widespread damage that results helps to render this form of endocarditis especially serious, and on this account it has received the name of malignant or **Infective Endocarditis**.

3. In other cases, however, the endocarditis is **Chronic** from the first, never passing through an acute stage. This variety occurs commonly in patients with Bright's disease

or who have contracted syphilis. The valve gradually becomes thick and stiff, until it can no longer shut, or perhaps open, properly, and, as before, regurgitation or stenosis, or both, result.

4. In yet other cases the heart disease is **Congenital.** The fault here is that the heart has failed to develop *in utero*

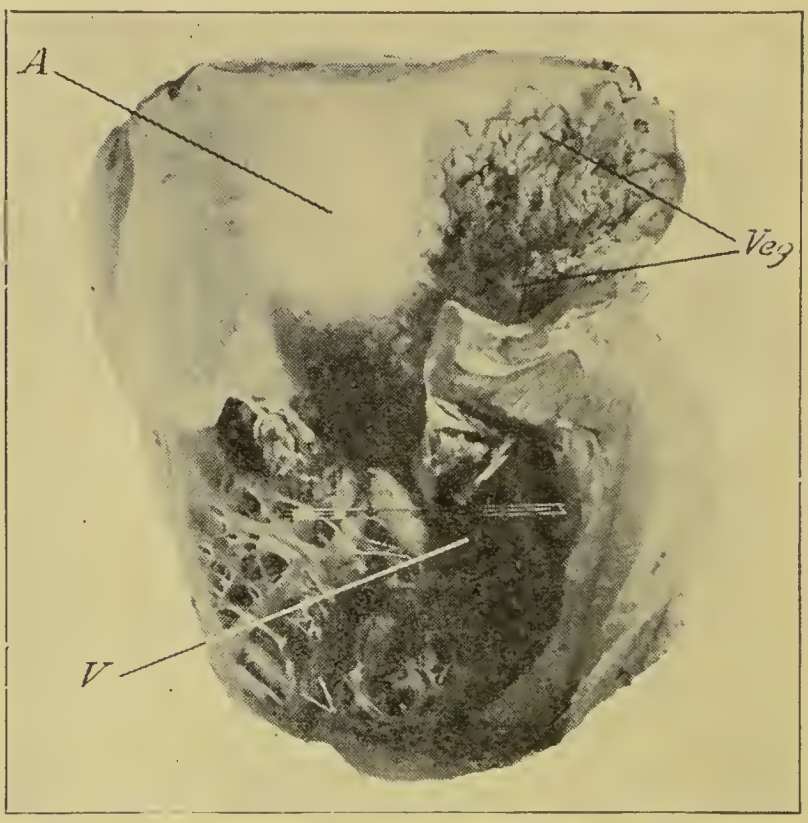

FIG. 1.—INTERIOR OF HEART FROM A CASE OF INFECTIVE ENDOCARDITIS.

A, Auricle; *V*, ventricle; *Veg*, a mass of infective vegetations spreading over the lining membrane of auricle.

as it should. Most frequently the opening between the ventricle and the pulmonary artery is so narrow and deformed as barely to admit the point of a probe. Sometimes, however, the partition between the two sides of the heart is defective, thus allowing the venous and arterial

blood to mix. Children with congenital heart disease can occasionally be recognized by their blue complexion; as a rule their lives are short.

5. Even if the valves keep healthy, the muscle itself may be diseased (**Myocarditis**). Thus in some obese people a great deal of fat is deposited in and about the heart, seriously weakening it (**Fatty Disease** of the heart). Again, in many fevers, such as pneumonia or typhoid, the muscle is poisoned by toxins, its contraction grows feeble, and sudden heart failure may occur.

6. Another interesting form of heart disease is **Angina Pectoris**, which results from disease of the coronary arteries. These vessels become thick and rigid—sometimes, indeed, with so much chalky deposit that, post mortem, they need to be cracked open rather than cut open, and in this state they fail to convey enough blood to nourish the heart, the muscle of which is therefore enfeebled, and once again its action is seriously impaired.

7. Sometimes the surface of the heart, together with the pericardial membrane, is inflamed—a condition known as **Acute Pericarditis**. This is often associated with acute endocarditis as well, particularly in rheumatic cases; but even when it occurs alone, the inflammation commonly spreads into the underlying muscle, again with grave effects.

8. There remains as a last possible seat of disorder the regulating apparatus of the heart, and, as a matter of fact, the nerves are very frequently the cause of heart trouble. But when disturbed they are more likely to upset the rate of the beat, making it quick or slow or irregular, than to affect the integrity of the muscle. For example, sometimes when the nerves are poisoned by excessive tobacco-smoking or tea-drinking, the result goes no further than a rapid, irregular pulse. In other cases mental worry and overwork may have the same effect. Yet again, the nerves are

susceptible to stomach disorders, with which, as is well known, palpitation of the heart is not unusual. In all these cases of nervous or **Functional Heart Disease**, though the rhythm is troubled, the muscle is not seriously altered; consequently these cases do not as a rule lead to hypertrophy and dilatation, still less to cardiac failure.

9. And yet in one important form of heart disease, due to defective regulation, fatal syncope is likely to occur. In **Adams-Stokes Disease** a certain part of the heart that acts as the regulator of the beat, and is known as the bundle of His, is diseased, with the result that the heart goes very slowly indeed, perhaps only twenty beats a minute instead of seventy-two. From time to time, indeed, it stops for a while, when the patient suddenly loses consciousness, and, perhaps, is convulsed for want of blood to the brain. Finally, in a last seizure the heart stops for good.

Symptoms of Heart Disease.—In most cases of heart disease the symptoms are in the main due to the failure of the heart as a muscle. The circulation is no longer carried on efficiently, the blood begins to stagnate, and dropsy develops, especially about the ankles, in the abdomen (ascites), and in the lungs, producing breathlessness, cough, and expectoration. Not only this, but other organs feel the congestion. The liver swells, and the patient grows jaundiced; the stomach rejects its food; the kidneys excrete but little urine, and even this is laden with albumin; the brain is congested; and the patient becomes drowsy, wanders in his mind, or is delirious. Again the heart, never for a moment free from strain, begins to beat rapidly, feebly, irregularly, painfully. Even the very moderate exertion of walking becomes too much, if only because of the pain and the breathlessness. Finally, the patient dare make no effort at all, and unable even to lie down on account of his breathing, he spends the weeks or months that remain to

him propped up in bed or in a chair, day and night, vainly endeavouring to find relief from his great discomfort.

The *Treatment* of these cases is governed by three leading principles. First and most important, the heart must, so far as possible, be relieved of all strain beyond that which it can bear without ill-effect. Second, still further to relieve the heart, the bowels must be kept loose, the kidneys stirred to activity by diuretics, and, if necessity arises, the patient may be bled. Third, extra strength may be put into the heart by the prescription of cardiac tonics, especially digitalis.

Diseases of the Bloodvessels.

I mentioned a few pages earlier that hypertrophy and dilatation are called for, first, when the heart itself is diseased, and, secondly, when the task of driving the blood through the vessels is unduly increased. The former of these causes we have discussed, and now I want to take up the latter subject, more especially from the point of view of diseases of the bloodvessels.

We all know, of course, that the arteries are elastic and distensible tubes which, each time the heart pumps blood into the aorta, are stretched open to accommodate this influx. In fact, in some arteries, especially those running across the temples, we can actually watch this movement of distension. The pressure from within, which thus distends the arteries, is known as the **Blood-Pressure**. Between the beats of the heart, however, the distended arteries contract to their original size again, thus squeezing the blood within them and so pressing it forward into the capillaries. In other words, the circulation along the arteries is maintained partly by the pumping action of the heart, partly by the intermittent squeeze of the elastic arteries.

Suppose, however, that the arteries, as a result of disease,

lose their elasticity and become rigid. They can no longer expand to allow the blood to flow through them easily; they can no longer contract to squeeze the blood onward. How will these two changes affect the heart? By the first, of course, extra work is thrown on the heart in driving the blood through the narrower vessels. To understand this for yourselves, you have only to try to squirt out the contents of a hypodermic syringe, first with the needle off, and then with it on. The second change—the failure of the arteries to press the blood onward—deprives the heart of valuable assistance, and, once again, if the circulation is not to fail, the extra work must fall on the heart. For both reasons, therefore, compensation, leading to hypertrophy, dilatation, and, probably, to heart failure, is inevitable.

Since in these cases of heart disease the blame must be primarily laid on arterial disease, let us provide ourselves with the chief facts relating to this condition. Arterial degeneration, or **Arterio-Sclerosis**, occurs naturally in all old people, and, as a matter of fact, practically times the onset of their senility—the longer the degeneration is postponed the more active the old people will remain; but when it comes prematurely, even the middle-aged may grow old and decrepit before their time. In these latter cases, however, the unnatural sclerosis is usually the result of syphilis, gout, alcoholism, lead-poisoning, or Bright's disease; but whatever its cause, the effects are likely to prove disastrous. We have just seen how, if it affects the arteries all over the body, heart disease is likely to follow. We have now to realize some of its more local consequences when it particularly affects the arteries of some one organ. On these occasions the effects fall, not on the heart, but on the organ whose blood-supply has been interfered with by the sclerosis. Its arteries being narrowed by the disease, the organ is put, as it were, on short commons, is starved of blood, and, as the inevitable result, tends to break down.

Take, for example, arterio-sclerosis of the arteries to the brain. Here, in the absence of sufficient nourishment, the cerebral nerve cells cannot perform their duties properly, and the functions of the brain are likely to suffer. Indeed, we can account in this way for a whole list of mental and cerebral affections: in our lunatic asylums alone are congregated hundreds, perhaps thousands, of patients who owe their mental breakdown to this **Cerebral Atheroma.** But even when the change comes on gradually with old age, the patient loses his mental vigour, perhaps becoming childish and doddering.

In the same way I might take other organs besides the brain and the heart to illustrate the significance of arterio-sclerosis. In each instance, however, though the results would of course vary according to the normal function of the organ affected, the pathological cause is the same—namely, a defective blood-supply. Often, indeed, when a minute artery becomes so degenerated as to leave very little channel at all for the blood to pass, the latter clots and actually plugs the vessel. In this event, that part of the organ deprived of its blood may speedily die, and its function come to an abrupt end. This frequently happens in the brain, for example, when, on the artery to a nerve centre becoming blocked by clot, the nerve cells in the centre are injured, the nerve is paralyzed, and, as a result visible to us all, some muscular paralysis develops. This is the explanation of many cases of squint where an eye-muscle is paralyzed on account of a clot in a minute vessel supplying the eye-muscle centre deep in the brain.

Apart from clots, however, another result sometimes follows arterial degeneration, especially in the larger arteries such as the aorta. This is the growth of

Aneurisms.

To understand this development we have to realize that arterial degeneration, in addition to stiffening the coats of

an artery, tends sooner or later to weaken them. The process is very gradual, but, with the loss of its elasticity, the artery becomes more fragile. For all that, however, it is still required to resist the blood-pressure from within; and for a while it succeeds. But in course of time this pressure finds out the weakest part of the artery, which, unable to resist, begins to give way. It is as though, forcing water at high pressure along a rubber tube one part of which is worn and thin, you saw the tube bulge and perhaps burst at this point. In the same way the artery, at its weak point, bulges—this forms the **Aneurism**—and, like the tube, perhaps bursts. The likeliest place for an aneurism to appear is on the aorta, either in the chest or, less frequently, the abdomen. In either situation it tends to grow larger, and, being practically a tumour, its symptoms are mainly due to the way it presses on neighbouring organs. Thus in the chest it often presses on a bronchus, obstructing the breathing and making it noisy; on the œsophagus, making swallowing difficult; on nerves, producing paralysis, especially of the vocal cords; on the spinal column, where it eats away the bone until the spinal marrow is exposed, when, still pushing onward, it compresses the spinal marrow, thus paralyzing the legs (see Chapter XV.). Most often, however, after coming into contact with the bronchus or œsophagus, but, finding no support in these hollow organs, it bursts, and in a few moments the blood has gushed out and the patient is dead. Sometimes when the aneurism has eaten its way through the ribs or the breast-bone, it bursts through the skin, and the aortic blood spurts out in a great volume.

Of course, so far as the treatment of aneurism is concerned, the guiding principle is to relieve the pressure of blood that is daily forcing the aneurism to larger dimensions. This result is best attained by confining the patient to bed,

protecting him from any and every strain and excitement, and restricting his diet (the Tuffnell diet, you will remember, is intended for these cases). With these helps Nature is then placed at an advantage in carrying out her own cure, which is gradually to fill up the interior of the aneurism with clot. The method, however, is imperfect, and, as none better is known, these cases are often progressive.

Thrombosis and Embolism.

Let us first understand the meaning of the terms. The clotting of blood in a vessel, whether artery or vein, is called **Thrombosis**, and the resulting clot a "thrombus." If, as sometimes happens, a fragment of this thrombus breaks off and is swept away in the blood-stream to another part of the body, its onward career will ultimately be checked when it comes to an artery too narrow to slip through. The circulation along that vessel will be stopped, while the corresponding part of the organ, finding itself deprived of its blood-supply, probably undergoes death-changes. The fragment of clot that plugs a vessel in this way is called an "embolus," while the process itself is known as **Embolism**.

We have already noted that thrombosis may follow arterial degeneration. It also occurs, however, if the blood itself is not healthy (as in the various kinds of anæmia), or if the circulation begins to grow feeble and stagnant (as in advanced cases of cancer and consumption), and in many fevers (especially typhoid and influenza). The results of thrombosis vary according to whether an artery or a vein is affected. With arterial thrombosis, the blood-supply to the neighbourhood is, as we have seen, interfered with, and the tissues are seriously damaged. With venous thrombosis, on the other hand, the supply of blood to the organ

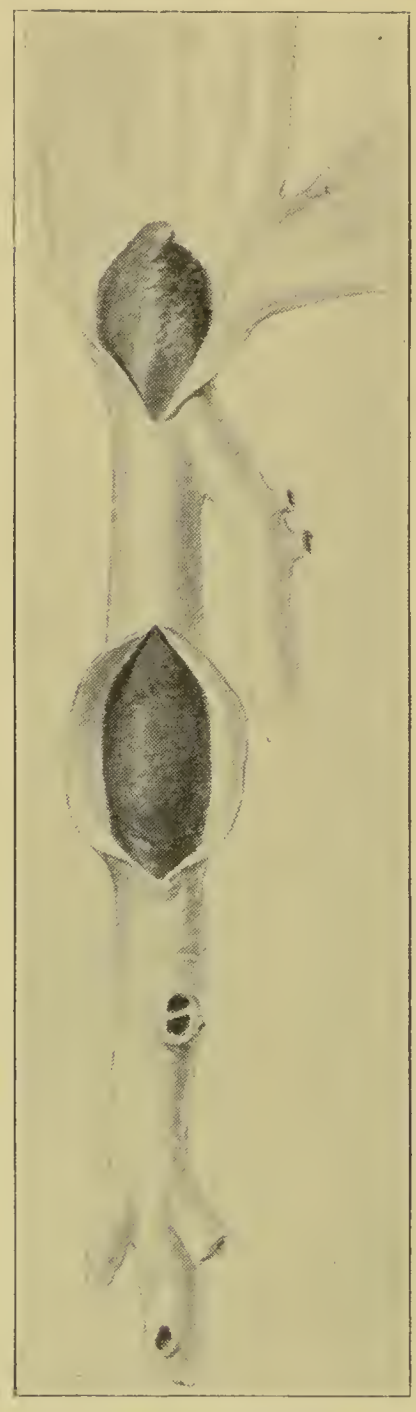

FIG. 2.—THROMBOSIS OF THE INFERIOR VENA CAVA.

Showing the interior of the vein completely blocked by antemortem blood-clot.

is not obstructed, but only the flow of blood away from the organ; and when this return is interfered with, the part becomes swollen with œdema. Thus, if the femoral vein is thrombosed, the leg is often greatly swollen; if the renal vein, the kidney, also swollen, ceases to secrete urine; if the portal vein returning blood from the abdomen, the latter is distended with ascites.

Embolism, unlike thrombosis, can never occur in a vein (since the current in the veins is from the smaller into the larger vessels), but only in an artery. The sudden interference with the blood-supply often leads to the death of the affected part, producing what is known as an **Infarct.** If an artery to a limb is embolized, gangrene itself often follows — for example, of the foot; if a cerebral vessel, a sudden paralytic stroke with, perhaps, loss of consciousness; if a renal vessel, blood and albumin appear in the urine. A pulmonary embolism produces cough and hæmoptysis; an embolism in the eye, blindness; in a coronary artery to the heart, fatal syncope.

Finally, I must mention that in some cases the embolism is produced, not by clot, but by fat, or even by an air bubble. Sometimes, after a surgical operation, some drops of fat, liberated by the incision, will pass into a wounded vein, thence through the heart, to an artery in the lungs, where they will act as an embolus. At other operations—especially if the patient is at all asphyxiated—when a vein has been opened, or perhaps merely nicked by the knife, air may be sucked in, leading to sudden death from air embolism. Lastly, in malignant disease, little particles of the cancer break away from the parent tumour as emboli; and wherever they happen to settle, are likely to develop into secondary growths or deposits.

Raynaud's Disease.

It has already been explained that the elastic arteries are rhythmically distended with the blood pumped by each beat of the heart. The further fact must now be mentioned that all arteries are sheathed in a thin layer of muscle fibres, which contract and relax under the influence of special nerves supplying the coats of the vessels. By this purely nervous influence, therefore, the calibre of an artery can be so diminished as to blanch the part which it supplies, or so widened as to flush the part with blood. In Raynaud's disease the arteries to the extremities—hands, feet, and sometimes the nose and ears—are in a state, as it were, of prolonged spasm, and, as a consequence, the extremities, deprived of a great part of their blood-supply, show some striking results. These are of three grades of severity. In the mildest type of the disease the fingers are white and "dead"—a condition not infrequently seen in cold weather with patients whose circulation is feeble. In the second grade the fingers become livid, swollen, and very painful. In the severest stage of all, when the arterial spasm is so

severe as practically to stop the circulation, the tips of the fingers or toes become gangrenous and may slough off. These attacks, which are commoner in women than men, are best treated by carefully protecting the extremities from cold, and by the application of electricity.

CHAPTER IX

INFECTIVE DISEASES

As in this and the following chapter I may have to ask you to modify in some degree the older ideas on infections, and to bring them into harmony with the results of more recent investigations, it will be well at the outset to make clear what is meant by "infective" diseases. They are not, be it noted, the same as "infectious" diseases; still less the same as "contagious" diseases. A contagious disease is usually regarded as a disease which can be conveyed from one individual to another by direct contact—leprosy, for example, or syphilis; while an infectious disease, though perhaps conveyed by contact, may also pass indirectly, as by the air—measles, for example. **Infective Diseases**, on the other hand, may be contagious or infectious or both or neither; their broad distinguishing feature is that they are caused by infection with some microscopic parasite, no matter how it gets to the patient. Infective diseases, therefore, include not only contagious and infectious diseases, but many others as well, such as pneumonia, rheumatic fever, malaria. In point of fact, the older terms, "contagious" and "infectious," are open to objection nowadays, since a contagious disease may be conveyed without direct contact, as by cups and tumblers, while infectious diseases, like scarlet fever and measles, may be transmitted directly as well as indirectly. "Infective," however, avoids all this

confusion, since it brings under one big heading all diseases the result of infection however brought about.

To give the mere list of the infective diseases, common and rare, would occupy a good deal of our time, and, perhaps, in the end we should be little the wiser. If, however, instead of this we occupy ourselves in learning the main facts relating to infections generally, we shall later be able to appreciate the details relating to individual infective diseases.

We have already noted that infection is always caused by a parasite or micro-organism. Most often this is a vegetable organism belonging to that family of fungi called **Bacteria**. Influenza, plague, tuberculosis, gonorrhœa, typhoid, are bacterial infections. In other diseases the parasite is animal, belonging to the class of **Protozoa**. This applies to, among others, malaria, syphilis, sleeping-sickness. Whatever the organism, however, the first important condition is that it should gain access to the body in which the disease is to be produced. Our bodies, however, are fairly safely encased in skin which is thick and tough enough to withstand most parasites. On the other hand, the delicate mucous membranes that line the various openings, etc., of the body, provide the weak point in our protective armour. In particular, the nose and throat, the windpipe and lungs, the stomach and intestines, the vagina and urethra, even the conjunctiva—each of these is a favourite "site of infection," where organisms can enjoy the warmth, moisture and nourishment which is so advantageous to their development. And yet the skin itself is by no means always proof against them, especially when, with the innumerable little knocks and scratches we all get in the course of the day, minute abrasions are made in the skin, exposing the softer tissue beneath.

In all the above instances we have assumed that the micro-organisms are found in one part of the body only—mucous membrane or skin as the case may be. This is

known as a **Local Infection**, and the main effects, at any rate, are limited to that locality. By way of illustration let us take the organisms known as "streptococci" and "staphylococci"—*i.e.*, those responsible for ordinary septic inflammations. If these locally infect the skin, the result is a boil, a pimple, a whitlow; if they attack the throat, they produce an acute tonsillitis; if the lungs, an acute bronchitis, an acute broncho-pneumonia, possibly an empyema; if the intestines, an acute enteritis or colitis; if the uterus, an acute endometritis; if the eye, an acute conjunctivitis; and so on. In each case the infection is the same, but the resulting symptoms differ according to the locality.

Only too often, however, the relatively simple problem of a local infection is speedily complicated by the organisms, having secured their local foothold, gaining entry to the circulation. They are then carried in the blood-stream to all parts of the body, and, of course, a much more serious condition results. Take the streptococci and staphylococci again. So long as they are localized, they are likely to do but little harm. Truly, they can, and probably will, cause a local abscess, but this can be dealt with successfully enough. But once they pass in numbers into the blood, they may settle in any part of the body (including the inside of the heart, setting up an infective endocarditis), producing abscesses here, there, and everywhere—a condition that is known as blood-poisoning, or **Pyæmia.** Sometimes, indeed, the starting-point of even a fatal pyæmia may be a seemingly trivial local infection. Thus I have known it to start in a whitlow; and, in one case, from the minute bites, which became septic, of pediculi in the scalp; while, of course, decayed and septic teeth are now well recognized as a fruitful cause of various septic diseases.

Or, take anthrax, for example. So long as this is a local infection, the diseased part of the skin can be cut out, and

the patient is probably safe again. But once let the bacilli pass from the local sore into the blood-stream, and the patient is likely to die. It is too late to cut out the skin, because the organisms are now swarming in every part of the body, and we are without the certain means of exterminating them.

In all these blood-stream infections we have, then, a **Generalized Infection** as opposed to a local infection. And as a rule the local precedes the generalized form, but not always. In some diseases the infection is generalized from the first and has no local symptoms. The best instance of this is perhaps malaria, in which the infective parasite is introduced direct into the blood by the bite of an infected mosquito.

So much for the beginnings of infections. Now let us turn to the *symptoms* that result. As we have already seen, these must vary with the site of infection. On the other hand, many parasitic organisms, no matter where they happen to establish themselves, secrete a poison or toxin which will probably be absorbed into the system, setting up certain constitutional symptoms which are always the same with the same kind of toxin. We can, therefore, conveniently divide the symptoms of infective diseases into two groups—*local* and *constitutional*. In typhoid fever, for instance, the local (abdominal) symptoms are diarrhœa, distension, intestinal hæmorrhage, perforation, etc., while the constitutional include fever, headache, and delirium.

With this short introduction we are now in a position to deal with the various infective diseases in turn. But before passing to this I should like to add a few words with regard to immunity, vaccines, antitoxins, etc.

Why, it may be asked, should so many of us escape infections, although our surroundings may teem with infective organisms? And why do others seem to catch every infection that comes their way? Without going deeply into the problems that are opened up by these questions, it will

be enough to recognize that some individuals have the power, greater or less, of resisting certain infections, and that this power lies in the fluids of the body which, by virtue of some chemical substances contained in them, confer on the individual what is termed **Natural Immunity**. On the other hand, some individuals purchase their immunity at the cost of a single attack of the disease. This **Acquired Immunity** accounts for the fact that, with many infective diseases such as smallpox, one attack protects against a second.

Of course, if only we had the means of making ourselves immune at a less cost than running the risks of a first attack, infective organisms would find no opportunities to produce their diseases. As a matter of fact, bacteriologists are unwearying in their efforts to discover artificial means of resisting diseases. Usually the attempt takes the form of vaccination—*i.e.*, inoculation with a vaccine. Indeed, so full of possibilities is this method that the **Vaccine Treatment** has in recent years attracted much interest. Its principle is simple. The vaccine consists of a quantity of dead micro-organisms with their toxins. These are injected into the body in the hope of stimulating it to produce the chemical substances in its fluids which will confer an artificial immunity against the disease which these organisms produce when alive.

Then again, another method of treatment is by **Antitoxic Serums**. The best instance of this is diphtheritic antitoxin, which is prepared in the following way: Some virulent diphtheria bacilli are cultivated, and at the end of about a fortnight, when they have formed a quantity of toxin, they are filtered off, and the remaining fluid, which contains the toxin, is injected in increasing doses into a healthy horse. The earlier injections give rise to fever and much constitutional disturbance, but gradually the horse develops in the fluids of its body a quantity of antitoxin, which neutralizes the diphtheritic toxin that is injected.

Ultimately the horse's blood becomes so antitoxic that a pint or more of toxin can safely be injected in a single dose. The serum, or liquid part of the horse's blood, forms the diphtheritic antitoxin, and if injected into a patient battling with the toxins of diphtheria, will quickly act as an antidote. At the present time, however, antitoxin treatment is available only for a small number of infective diseases; while vaccination, though of old-established use for smallpox, is of special use in typhoid, cholera, plague, and rabies.

In all cases, however, prophylaxis, or prevention, is the ideal course, whether by vaccination or by other means. To prevent a disease, we require to know what may be called its "natural history," more especially the channels of infection—*i.e.*, the sources from which the disease is likely to be acquired. Once these are understood, practical measures can be taken to stamp out the disease. Thus, typhoid fever was rampant in this country until comparatively recent years; but now that it has been traced to infected drinking-water, milk, oysters, etc., and its spread from one patient to another has been traced to fæces, urine, etc., the control of the disease has become a relatively simple problem in public health. Again, in the case of malaria, so soon as proof had been made that the disease is conveyed by mosquitoes, prophylaxis could be assured by clearing away those swampy places where the mosquito breeds.

Just one point more. To prevent the spread of certain diseases from one patient to another we must know various facts that bear on its infectiousness. Thus, we must know the **Incubation** of the disease—*i.e.*, the period between the day of infection and the day when the first symptoms disclose themselves. This gives us the period of **Quarantine**, during which a suspected case must be kept under observation. Finally, we must know the period during which the infectiousness (if any) continues, in order that **Isolation** may be arranged.

CHAPTER X

INFECTIVE DISEASES—*Continued*

HAVING now discussed the distinction between local and general infections, we can from this point of view consider the more important infective diseases. These may be conveniently arranged in three groups: (I.) Infections which, at first local, usually become generalized; (II.) those which remain local, with or without toxic absorption; and (III.) general infections in which the local site of infection is doubtful.

I.

Septic Infection.—The two septic organisms, streptococci and staphylococci, are responsible for so many local inflammatory infections that only a few examples can be given. Thus, they account for the large majority of abscesses, wherever situated. If they gain access to the surface of the brain (spreading as a rule from a suppurating ear) or to the spinal cord (as from a bedsore), they produce septic meningitis. In the mouth they cause ulcers, dental caries, tonsillitis. Along the alimentary canal they set up ulceration, or, when not primarily responsible for this, speedily collect in the ulcer, which thereupon becomes septic and may spread through the walls of the stomach or intestine, producing septic peritonitis. If they pass into the lungs (as is often the case when the mouth is septic), a

septic bronchitis or broncho-pneumonia may follow, with, perhaps, the formation of an empyema.

In all these local instances a risk is, as we have seen, that the organisms, passing into the blood, may be circulated to all parts of the body, in which event they may inflame some one or more organs. In scarlet fever, for example, which may be regarded as a streptococcal infection of the tonsils, the bacteria are specially liable, after absorption, to attack either the kidneys (producing scarlatinal nephritis), or the heart (producing endocarditis), or the joints (scarlatinal rheumatism). In other cases of local infection, however, as in the uterus after delivery, the organisms are more likely to produce a general blood-poisoning, with pyæmic abscesses in many parts. In fact, in no case, however trivial the local infection, is it possible to say how severely or quickly generalization may take place. The practical conclusion, therefore, is clearly that no local septic infection, whether decayed tooth, boil, ulcer, or inflamed mucous membrane, is altogether free from grave possibilities, and therefore its local treatment and cure should be undertaken as speedily as possible. It is no exaggeration to say that, if this were done in all cases, numbers of serious, even fatal, diseases would be prevented.

Pneumococcal Infection.—The pneumococcus, though long ago identified as the bacterium responsible for pneumonia, has in more recent years been proved to be the cause of disease over a much wider field than the lungs alone. The infection, even if localized at first to the lungs, soon becomes generalized, and the blood may teem with pneumococci. And yet as a rule the local effects are by far the most prominent. When, however, the organisms, in addition to producing pneumonia, attack other parts, serious complications will arise. Thus, in the brain they may set up pneumococcal meningitis, or even a pneumo-

coccal cerebral abscess; in the abdomen, pneumococcal peritonitis; in the joints, pneumococcal arthritis; in the intestines, pneumococcal colitis. Sometimes, indeed, these inflammations arise even in the absence of pneumonia, and it must be concluded that the organisms have entered the circulation otherwise than through a pneumonic lung. And, as a matter of fact, it is known that, for example, middle-ear disease (otitis) is often pneumococcal—sometimes even a cold in the eye (conjunctivitis) is caused by the same organism—so that it is not difficult to understand that the pneumococcus has several portals at which to enter the circulation.

Influenzal Infection.—The influenza bacillus, though at first requiring some local foothold from which to produce its general effects, usually causes only mild local symptoms. Thus, an attack often begins with a slight cold in the head, a sore throat or a huskiness of voice, suggesting the nose, throat, or larynx as the point of attack; but these local effects are speedily outweighed by the constitutional symptoms. The patient aches all over, his temperature rises rapidly to 102°, 103° F., or higher; his pulse is rapid and his respiration hurried. In two or three days, however, the fever subsides, and the attack is over except, perhaps, for an after-feeling of prostration.

Such a case, however, represents the least the influenza bacillus can do. In other cases the organisms in the larynx spread down to the lungs, causing influenzal bronchitis, broncho-pneumonia, pneumonia, or even empyema. In fact, these pulmonary complications are usually severe, and frequently fatal. Or, again, the bacilli, reaching the brain, may set up influenzal meningitis; in the joints, influenzal arthritis; and so on.

Gonorrhœal Infection.—In this variety the bacteria—gonococci—produce, in most but by no means all cases, a local infection only. The condition being venereal in origin,

the local sites of infection are as a rule the male urethra or the vagina ; but in either sex the inflammation is likely to spread locally—to the testis, or to the uterus and thence to the Fallopian tubes, where the damage may be so considerable as to result in permanent sterility. Less frequently the site of infection is the eye, where it results in a very intense inflammation known as "ophthalmia." Nearly all these cases, however, are in the new-born children of mothers with gonorrhœal vaginitis (the infants' eyes becoming infected during delivery), and, as is well known, this **Ophthalmia Neonatorum** is responsible for a considerable proportion of the inmates of our blind asylums.*

When the infection lies in the genito-urinary passages, the neighbouring glands in the groin are commonly inflamed and swollen (bubo), and from here it is a small step to the generalization of the infection. If this occurs, the likeliest parts to be affected are the joints, particularly the elbow, wrist, ankle, and foot. This gonorrhœal rheumatism, however, is a severer inflammation than the other form we have mentioned—scarlatinal rheumatism—and may, indeed, lead to the joint becoming permanently immovable. Again, gonococci in the blood-stream may attack the valves of the heart, producing valvular heart disease ; or the membranes of the brain, setting up gonorrhœal meningitis; or the surface of the lung, causing pleurisy, or even empyema.

Anthrax.—This disease, in which the infection, at first local, is likely to become general, is acquired from animals, particularly cattle and sheep, in whom it is known as "splenic fever." Farmers, shepherds, and drovers are sometimes infected from the living animal, but the danger is greater for those who handle carcasses, etc.—butchers, wool-sorters, tanners, furriers. Usually inoculation is made through a

* Ophthalmia neonatorum having recently been made a notifiable disease by the Local Government Board, a gradual but steady reduction in the number of the blind population is assured.

scratch on the hands or face, where, within a short time, a pimple forms, which soon grows to a large angry-looking boil. So long as the anthrax bacilli remain thus localized, the patient may feel nothing amiss beyond the discomfort of the boil; but unless the infected skin is speedily excised, the organisms become generalized, the patient thereupon developing serious symptoms—prostration, delirium, collapse—and probably dies, though the use of a serum or, more recently, of salvarsan, has made the outlook more hopeful.

Glanders, another animal infection, is acquired particularly by stablemen from horses, the bacillus gaining entry usually through a scratch or by the bite of a horse. Sometimes, however, if the animal happens to cough or sneeze in the groom's face, the local site of infection is the eyes, nose, or mouth. The inoculated part becomes inflamed, ulcerates, and discharges. Later, as the infection becomes generalized, a skin eruption breaks out, consisting of pustules, perhaps half an inch across, which, like the original lesion, ulcerate and discharge. At the same time the patient becomes seriously ill, and probably dies within two weeks to four months.

II.

Hydrophobia is the affection in man corresponding to rabies in animals, and is usually conveyed by a dog-bite. For some weeks afterwards nothing is noticed in the bite, which seems to heal satisfactorily, but later the scar grows tender and painful, and soon the alarming symptoms of the disease begin. The patient becomes restless and very irritable. Soon he feels a choking sensation which becomes worse until any attempt to drink, or even the very sight of water, throws the muscles of the throat into violent and intensely painful spasms. At the same time the patient's irritability passes into marked excitability, and frequently he becomes maniacal. After two or three days,

however, this stage passes, and he sinks into a quiet paralytic condition and dies. The treatment is by Pasteur's antirabic inoculation. Pasteur found that if rabbits were inoculated with rabies their spinal cords contained the virus of the disease, but, after being dried for a fortnight, became innocuous again. If, therefore, a patient, bitten by a mad dog, receives a series of injections prepared from these rabbits' cords at first a fortnight old, then thirteen days, then twelve days, and so on, until the last injections are of highly poisonous cords only three or four days old, he will gradually acquire immunity against the disease. This treatment, of course, must be undertaken as soon as possible after the accident; but if there should be any question as to the state of the dog, the animal should not be killed, but kept under close observation to allow the symptoms of rabies to appear.

Tetanus.—The bacillus of tetanus occurs naturally in soil, especially cultivated soil, and the inoculation is generally made by dirt getting into a scratch, or by a dirty splinter or rusty nail. The infection, therefore, is local, and, be it noted, remains local throughout. And yet, in spite of this, constitutional symptoms arise—violent, agonized convulsions. The explanation is that, though the bacilli do not pass into the circulation, their toxins readily make their way up the nerves from the affected part and reach the spinal cord—a process which is supposed to account for the symptoms in hydrophobia as well. The first step in the treatment of tetanus, therefore, is to cut out the wound in which the bacilli lie manufacturing their toxins. After this, it is usual to inject tetanus antitoxin prepared from the blood of a horse (see p. 59). This preparation, however, is by no means as certain as diphtheritic antitoxin, and to quieten the patient it may be necessary to give him large doses of chloral and bromide, or even to keep him under chloroform.

Actinomycosis, common enough among cattle, but rare in man, is due to a fungus—the ray-fungus, or actinomyces. This parasite is probably taken in with the food; at any rate, the site of inoculation is usually in or about the mouth, but it may lie in the intestines, the liver, or even the lungs. Wherever situated, however, the fungus occasions a local, chronic swelling, which ultimately opens to the surface, and from the sinus thus produced pus oozes. If the ray-fungus comes into contact with the jaw, the bone may be partly eaten away.

III.

Finally, two acute nervous diseases may be mentioned, each of which is infective, though in the first the parasite is unknown, and in neither has the local site of infection been identified. The evidence is strong, however, that in both the diseases now to be described the site of infection is the nose or throat.

Acute Poliomyelitis (*Infantile Paralysis*). — In this disease, the infective nature of which is indicated by its occurrence in epidemics and by its experimental conveyance from children to monkeys and from one monkey to another, the organism, whatever its nature, attacks the spinal cord, destroying nerve cells and thus producing paralysis. The constitutional symptoms as a rule are only slight, but as they subside the child is left with a greater or less amount of paralysis in one or more limbs. Recently a further interesting fact has been ascertained with regard to this disease—namely, that in some cases the inflammation attacks the brain as well as the cord. In these circumstances cerebral symptoms such as unconsciousness are likely to develop, and the patient may be left permanently feeble-minded. Partly owing to this cerebral involvement, partly to the fact that the disease has been found to occur in adults more frequently than had

been supposed, the name "infantile paralysis" is less often used, and, instead, the condition is spoken of as acute polio-

FIG. 3.—ANTERIOR POLIOMYELITIS.
Showing the left leg paralyzed and withered.
(Bradford and Lovett's "Orthopædic Surgery.")

encephalitis. On account of its newly proved infectiousness the disease has recently been made notifiable.

Cerebrospinal Meningitis is a form of meningitis of

both brain and spinal cord, due to a bacterium, *Diplococcus intracellularis*. Being often associated with a rash, the disease is sometimes known as "spotted fever." It has frequently occurred in epidemics, though sporadic cases are common; in fact, there is little doubt that the so-called post-basal meningitis of babies, which is often seen in ordinary hospitals, is really the sporadic form of cerebro-spinal meningitis (see also p. 92).

CHAPTER XI

INFECTIVE DISEASES—*Continued*

The Specific Fevers.

Under the name of "specific fevers" are included several infective diseases, most of which, though very common, still elude the efforts of bacteriology to find their cause. Thus the micro-organisms have yet to be identified which are responsible for measles, German measles, whooping-cough, chicken-pox, mumps, and smallpox; in the cases of diphtheria and typhoid fever they have long been known; while in scarlet fever the organism is generally identified with the streptococcus.

Measles, or *Morbilli*—the Italian for "the little plague"—though still regarded by the laity as a more or less negligible disease, is responsible for nearly 30 per cent. of the total infant mortality from the specific fevers, or about four times as many deaths as from scarlet fever and diphtheria together. It is essentially a disease of childhood, and only rarely occurs twice in the same subject. After an incubation period of ten or eleven days, it begins suddenly with fever, sneezing, and running from the nose and eyes. On the second or third day this "cold in the head," as it is often regarded at the time, seems to be better, but if the inside of the mouth is examined at this stage a few whitish spots—*Koplik's spots*—can generally be seen scattered over the mucous membrane; and these, taken in conjunction with

the other symptoms, are enough to betray the nature of the oncoming disease. On the fourth day, however, all doubt is set at rest by the appearance of the rash. This first shows itself on the temples, but spreads within a few hours over the face—making it look blotchy and swollen—to the neck, trunk, and limbs, until the whole body is covered in irregularly shaped darkish red spots. A few days later the rash begins to fade—though the skin looks mottled for several days longer—the temperature falls to normal, and the attack is over.

In more serious cases, however, the infection of the nasal mucous membrane spreads down the larynx and trachea to the lungs, there to set up bronchitis or broncho-pneumonia; and it is to these complications that so many deaths are attributable. Epidemics of the disease are extremely difficult to control, largely owing to the fact that the most infectious stage is before the rash appears (when no medical opinion is likely to be sought), while the child, sneezing and coughing, is scattering infected mucus and saliva in all directions.

In **German Measles**, or *Rubella*, after an incubation of sixteen to seventeen days, the rash, which is not very unlike that of measles, shows itself, not on the fourth, but on the first day of illness; it is usually unaccompanied by fever, and soon fades. Indeed, many children are in no way inconvenienced by the disease, and yet, on account of its very infectious nature, they must be strictly isolated for ten days after the rash first showed itself.

Scarlet Fever, or *Scarlatina*, the virus of which is conveyed not only by direct contact, but through the medium of clothing, books, milk, etc., is by far commonest among children, though not often attacking babies. After incubating as a rule for only three or four days at the most, it begins suddenly and violently. Vomiting, headache, and even fits may mark its onset as the temperature runs up to

103° F., or higher. But soon the characteristic sore throat makes itself felt; the tonsils become much swollen by inflammation, and this spreads to the palate, uvula, and into the nose, which is now liable to be blocked by secretion; at the same time the glands on both sides of the neck enlarge. Meanwhile the rash will have appeared—at latest on the second day, but often as soon as the latter part of the first day—as a brilliant, scarlet eruption seen first on the chest and neck, but soon quickly spreading all over the body except on the face, the cheeks of which are merely flushed. True, the rash itself, seen at a little distance, looks like a uniform vivid flush, but at closer quarters it appears as innumerable scarlet points, closely set, and none bigger than a pin's head. Within a few hours or days the rash fades, but its after-affects are seen, perhaps as early as the end of the first week, when the skin begins to flake or peel, this process of *desquamation* taking a month or more to be completed. About the same time that the rash fades the furred tongue clears and becomes bright red—the so-called "strawberry-tongue"—and the temperature declines to normal by the end of the week.

In many cases, however, the course is not so uneventful. The tonsils may ulcerate or slough; the glands in the neck may suppurate and require to be opened; the inflammation may spread from the throat up the Eustachian tube to the ear, causing acute otitis and perhaps chronic otorrhœa, which itself may spread later to the brain, setting up fatal meningitis. Not infrequently, as was pointed out in an earlier chapter, scarlatina may be the cause of acute endocarditis leading to permanent heart disease. Sometimes it causes acute inflammation of the joints very similar to that of rheumatic fever, and known as "scarlatinal rheumatism." Yet again the virus may, from a fortnight to three weeks from the onset, be the cause of Bright's disease, which, at first acute, may leave the kidneys permanently diseased.

Diphtheria, the incubation period of which varies from two to five days, or even longer, is, like scarlet fever, an infection of the tonsils, the responsible organism being the Klebs-Loeffler bacillus. This diphtheritic tonsillitis is so intense that the surface layers of the tonsils and even of the neighbouring palate usually slough, forming the so-called diphtheritic "membrane"; at the same time the glands in the neck become swollen and tender. In many cases the inflammation spreads to the nose, causing a discharge which is often blood-stained. The temperature is raised, though not as a rule very greatly, and the urine may contain albumin—an occurrence which is of no little diagnostic value in doubtful cases. In young children diphtheria is liable to attack the larynx rather than the tonsils—**Laryngeal Diphtheria**—in which event the lining membrane of the air passages may become so swollen as seriously to obstruct the breathing; the operation of tracheotomy (*i.e.*, opening the trachea below the site of the inflammation) then becomes imperative.

Of the complications of the disease the only one that need be mentioned is **Post-Diphtheritic Paralysis.** Though as a rule showing itself only after convalescence has begun, it may speedily lead to the paralysis of all four limbs. The first indication of its onset is to be looked for in the palate, which, becoming paralyzed, cannot be raised to close the opening between the throat and nose; the child's voice, therefore, takes on a nasal twang, while its attempts to drink lead to the regurgitation of the fluid through the nostrils. Without often being fatal, unless the heart or diaphragm is affected, this paralysis disappears only slowly, but the prospect of ultimate recovery is good.

Whooping-Cough, or *Pertussis*, begins, after about ten days' incubation, with symptoms which are often indistinguishable from those of mild bronchitis, and not until the end of a week or more is the peculiar cough likely to be

heard. With the first whoop, however, the nature of the case is obvious to everyone; but by those who are experienced an earlier diagnosis can generally be made, even in the absence of any whoop, by the paroxysmal nature of the cough—the child being impelled to cough a dozen times or so before it can get the next breath. Even apart from these paroxysms, suspicion should be roused in the bronchitic stage if the child, after coughing, is liable to vomit. The early diagnosis of the disease is important because the cases are most infectious in the bronchitic stage, and little, if at all, once the whoop has well established itself. As a cause of infant mortality, pertussis is responsible for more deaths than all the other specific fevers together, measles included. This is accounted for by the fact that a frequent complication is broncho-pneumonia, which is often fatal.

Mumps, or *Specific Parotitis*, is an infective inflammation of one, or, more generally, both parotid glands. With an indefinite incubation period of two to three weeks, the disease begins with pain and swelling behind the jaw and in front of the ears; as a result the mouth cannot be properly opened, and chewing is difficult and painful. By the end of a week the parotids begin to resume their normal size, and in a fortnight from the onset the patient is free from infection.

Chicken-Pox, or *Varicella*.—Period of incubation, ten to fifteen days. The disease shows itself by a rash, at first nothing more than little spots, which, however, become capped with blisters (vesicles) within twenty-four hours. They may be few or many, but fresh spots are likely to appear daily. They form all over the body, including the scalp, but are always sparser on the limbs than on the trunk. Accompanying the rash for a day or two is a mild degree of fever. As the vesicles dry up their contents form scabs, which gradually separate from the skin; but until

the last of these scabs has fallen off, the case is to be regarded as infectious.

Smallpox, or *Variola*, after incubating for about twelve days, begins suddenly with four well-marked symptoms—a shivering attack, intense headache, severe pains in the loins, vomiting. The temperature rises quickly to 103° or 104° F., and the patient is very ill almost from the beginning. On the third day the typical rash appears—small red spots, feeling hard and "shotty"—which come first on the forehead, wrists and ankles, and later on the trunk and limbs, but sparser on the trunk than on the limbs. With this new development the temperature falls, and the patient feels so much better that, if not under medical control, he may return to his work. But the disease has yet to produce its worst effects. In three days more the spots develop vesicles, each of which becomes inflamed and filled with pus. The inflammation grows so severe that the skin becomes swollen and tense until the patient's features are likely to be altogether unrecognizable. Meanwhile, septic absorption takes place from the pustules, with the result that the temperature mounts up again, and the patient is soon very seriously ill, and in many cases becomes delirious. The symptoms abate only at the end of a fortnight, when the pustules begin to dry up, though even then the pustules will leave scars pock-marking the patient for life. In some cases of variola the typical rash is preceded by other more transient rashes, especially over the lower part of the abdomen, and sometimes by a hæmorrhagic rash, though in these latter cases—"malignant smallpox"—death often takes place before the third day—that is to say, before the disease has properly disclosed itself.

Smallpox affords the best instance of the efficiency of vaccine treatment, and it has, of course, been practically abolished in many countries by the practice of **Vaccination**. This consists in inoculating a healthy but susceptible sub-

ject with fluid taken from a vesicle on a calf suffering from cow-pox; the site of the inoculation becomes inflamed and forms a pustule, which dries up in three weeks. At the cost of this comparatively slight inconvenience, the individual is protected for several years from the dangers and disfigurement of the incomparably more serious smallpox.

Typhoid Fever, or *Enteric Fever*, is the disease produced by the *Bacillus typhosus* (see Fig. 4), which gains admission

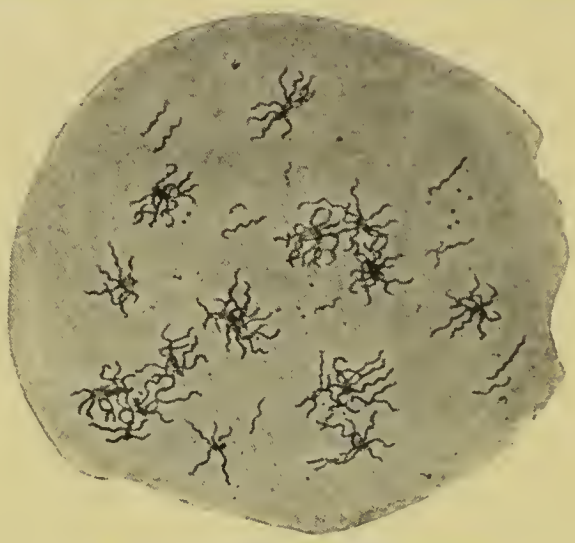

FIG. 4.—BACILLUS TYPHOSUS.
(Green's "Pathology.")

to the system usually by an infected water-supply or by infected food, especially milk or oysters. Nurses who are not scrupulously careful in handling their cases are liable to contract the disease direct from their patients, whose fæces and urine always teem with the bacilli. Further, it is now known that in some cases the bacilli continue to infect the excretions for a long time, even for many years, after the original fever, and such cases, which are spoken of as "typhoid carriers," may spread the disease wherever they go.*

* Thus the epidemic of typhoid fever which attacked one quarter of New York in 1909 was traced to the milk supplied by a farmer three hundred miles away, near Camden City. The farmer

Once having gained admission to the alimentary canal, the bacilli attack the patches of lymphatic tissue known as "Peyer's patches," which are scattered along the length of the small intestines. At first the patches become inflamed and swollen, but at the end of a week they are destroyed by the intensity of the inflammation, and begin to slough. As each slough is cast off, leaving an ulcer in its place, there is the risk either of an underlying bloodvessel being torn open, in which event serious hæmorrhage is to be feared, or of a hole being left in the intestine passing into the peritoneum, through which the fæces may escape, setting up fatal peritonitis.

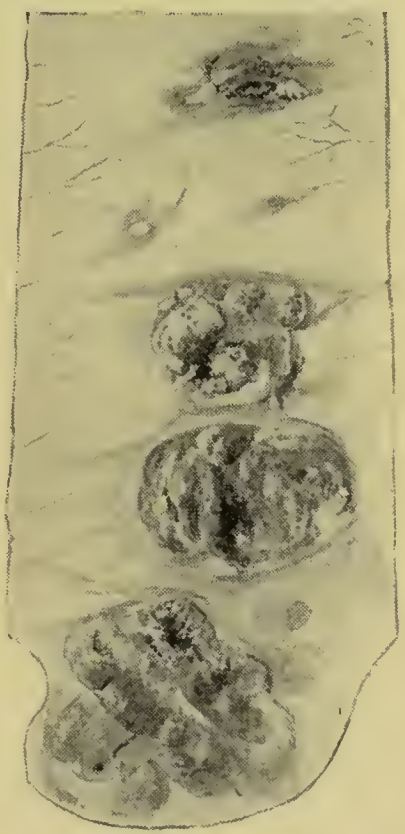

FIG. 5.—TYPHOID ULCERS.

A small piece of small intestine laid open to show three or four Peyer's patches sloughing in the course of enteric fever. The sloughs are just beginning to separate.

After an incubation period of about fourteen days the symptoms begin, but only insidiously. The patient gradually feels out of sorts, with headache and diarrhœa as the most prominent symptoms, supplemented in many cases by bronchitis and epistaxis. The temperature rises day by day for a week, and then remains fairly stationary at 103° or

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was found to be a typhoid-carrier, who had contracted the disease as long ago as 1864. For many years the neighbouring town had been supplied with his milk, and so prevalent was typhoid among its inhabitants that the disease had come to be known in the locality as "Camden fever."

104° F. for another week, after which it slowly falls until at the end of the third week it reaches normal, and the attack is at an end. Throughout the entire period the pulse, though quickened, is not as rapid as would be the case in other conditions with so high a fever; indeed, this relative slowness of the pulse is very suggestive of enteric fever. By the end of the first week the patient has been reduced to a dull, apathetic state, which alternates with a low delirium; his cheeks are flushed and his eyes bright. About this time the spleen can be felt to be enlarged, and the rose-red spots which constitute the rash of typhoid fever begin to appear on the abdomen and elsewhere—perhaps only two or three spots all told, and therefore not easy to find, but often a score or more. They fade when pressed upon by the finger, and disappear altogether in two or three days, while fresh spots appear elsewhere. It is in the second week, moreover, that the abdominal symptoms become prominent, on account of the intestinal ulceration. The abdomen becomes swollen and tense; the stools are liquid, yellow, and offensive, and may now begin to be tinged with blood as the sloughs become loosened. In some cases when a copious hæmorrhage from the bowel indicates the opening of an important bloodvessel, the loss of blood may be so severe as to cause death. In the third week, as the symptoms abate, the mind clears and the appetite returns, but the patient now enters the stage when perforation and peritonitis are likeliest to occur. Many cases at the end of three weeks suffer a relapse, though this second attack is often shorter and milder than the first.

A word may here be added in explanation of *Widal's reaction*, a bacteriological test for typhoid fever which is of great value. By the second week of the disease the patient's blood comes to possess certain chemical properties which make it more or less poisonous to typhoid bacilli. The test consists in adding a little of the patient's blood-

serum to a culture of active typhoid bacilli (these bacilli are endowed with the power of motion, and can be seen swimming about in a drop of the culture-fluid); the effect is to paralyze the bacilli, which slowly move together into a motionless clump.

Typhoid fever carries with it a long train of serious complications. Apart from hæmorrhage and perforation, the following may be mentioned: Pneumonia, pleurisy, acute Bright's disease, otitis, cancrum oris, meningitis, thrombosis of the femoral vein, incontinence, and bed-sores.

Treatment of the Specific Fevers.—In connection with the treatment of the specific fevers careful attention is required to the effective isolation of the patient and of any-one who may have been exposed to infection. The following table gives the usual periods of isolation and quarantine:

	Isolation.	Quarantine.
		Days.
Measles	14 days after rash appears	16
German measles ...	10 days after rash appears	20
Scarlatina ...	6 weeks, provided no otorrhœa, etc.	10
Diphtheria ...	4 weeks, provided two bacteriological examinations prove satisfactory	12
Whooping-cough	5 weeks from onset; 2 weeks after whoop stops	21
Mumps	2 weeks from onset	24
Chicken-pox ...	when all scabs have separated	20
Smallpox	when all scabs have separated	16
Typhoid fever ...	when excretions are free from infection	14 to 21

So far as the medical treatment of most of these diseases is concerned, the necessary measures largely resolve themselves into protection from chills, a light diet, and perhaps confinement to bed, together with the special treatment of

the various complications as they arise. In scarlet fever it is all-important to attend to the hygiene of the throat and nose. In diphtheria, though the same line of treatment must be carefully followed, more can be looked for from the injection of antitoxin. Finally, in typhoid fever the first indication is derived from the pathological changes going on in the intestines, which make any but a perfectly bland and liquid diet inadvisable; milk, beef-tea, and farinaceous foods must be the stand-by, though most physicians at the present day have no objection to some more solid food, provided it will have become liquid by the time it reaches the intestines.

CHAPTER XII

INFECTIVE DISEASES—*Concluded*

Syphilis—Tuberculosis.

I. Syphilis.

Syphilis, an infective disease at first local but later generalized, is due to an animal parasite—*spirochæta pallida*. This organism, though unable to produce a local infection through the unabraded skin, finds an easy foothold in any of the delicate mucous membranes of the body, where, as we shall see immediately, it soon produces a characteristic sore in which, and in the discharge from which, it multiplies abundantly. This site of inoculation is therefore highly infective, and, if it comes into contact with any other mucous surface or a skin abrasion, some of the spirochætes are speedily transferred, and the individual thus infected acquires the disease. In almost all cases this spread is venereal; but doctors, nurses, and midwives are exposed to a special risk, since in vaginal examination inoculation may take place at an unsuspected abrasion on the examining finger. Sometimes, however, the primary sore is on the lip, in which case it may be infected on the lips of another, either by kissing, or by tumblers, spoons, etc. Wherever inoculated, the disease, if untreated, runs a course which is customarily divided into three stages—primary, secondary, and tertiary.

Primary Syphilis.—Within a month or so of infection the sore develops as a small red spot, which, after enlarging, ulcerates and discharges pus. At the same time the part around becomes hard to the touch, and the whole constitutes the syphilitic *chancre*. It represents the stage of local infection.

Secondary Syphilis.—This stage corresponds with the generalization of the local infection, when the spirochætes, having multiplied in the chancre, are carried in the blood-

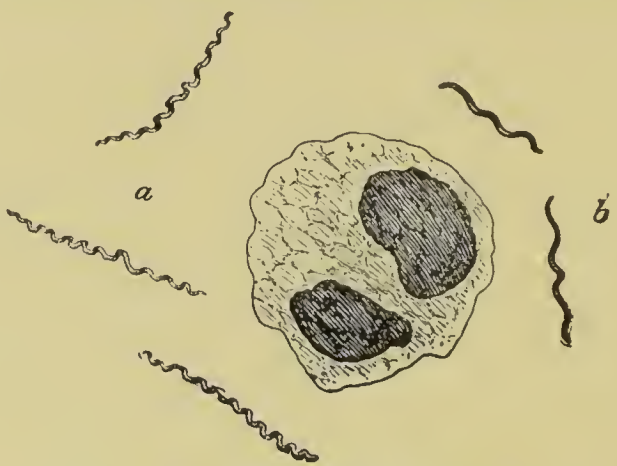

FIG. 6.—SPIROCHÆTE OF SYPHILIS.

Two varieties of spirochæte, that on the left (*a*) being *spirochæta pallida*. For comparison of size a white blood-corpuscle is shown in the centre of the figure.

(Green's "Pathology.")

stream to all parts of the body. It usually occurs from six to twelve weeks after the primary sore, and causes a greater or less degree of fever and anæmia. Further, colonies of spirochætes, settling in the skin, produce numbers of reddish-brown spots, which make up the *secondary rash;* this is thickest on the chest, abdomen, and front of the arms. In places where the skin is habitually moist—about the mouth and anus, in the armpits, between the toes—these spots become soft warty growths, intensely infectious, of course, and are known as *condylomata*. Similar growths

inside the mouth, on the tongue, or in the throat, are liable to ulcerate (especially on the tonsils, producing an ulcerated sore throat) and render the saliva highly infective. Other colonies often settle in the eye, where they are responsible for acute iritis. Finally, the hair falls out, or at least becomes thin.

Tertiary Syphilis.—This stage, uncertain in its oncoming, may begin at any time from a few months up to many years after the secondary symptoms. The spirochæte is still the cause, but its effects now take the form of tumours, called *gummata*, which may appear in practically any part or organ of the body. The symptoms of these depend, of course, on their situation: thus, a gumma in the brain causes the symptoms of a cerebral tumour; in the liver it may produce ascites, jaundice, and digestive troubles; and so on. Yet another very important result of tertiary syphilis is arterial disease. This condition we have already studied (see Chapter VIII.), and it will suffice to recall that syphilitic arterial disease may itself be the cause of thrombosis and aneurisms.

Still another late effect of syphilis must not be overlooked—namely, those chronic nervous diseases which have been grouped under the name of "parasyphilis." The two parasyphilitic affections are locomotor ataxy and general paralysis of the insane. They do not as a rule, however, occur until some twelve or fifteen years after the primary sore (see pp. 96 and 107).

Congenital Syphilis.—So far I have been speaking of acquired syphilis—*i.e.*, the disease acquired by local inoculation. We have now to consider that form which is inherited by a child from an infected parent.

In a word, the distinguishing point about this variety is that the child, having been infected *in utero* through the maternal placenta direct into its own blood-stream, never shows any local site of inoculation—that is to say, the dis-

ease begins at the secondary stage. Except in this one particular, the congenital and the acquired forms may run identical courses.

A syphilitic child, though often feeble and wasted at birth, may be vigorous and plump. Within three or four weeks, however, the secondary symptoms appear—the *rash*, especially on the buttocks, where it is often ulcerated, and the highly infective condylomata in moist places. Condylomata inside the nose are especially common; here, half blocking the air-way, they cause the well-known *snuffles*. Occasionally gummata may be present, while rarely, if the child survives, parasyphilis may develop. Much more frequent among the later manifestations is inflammation of the cornea (interstitial keratitis), which may cause blindness. Finally, a few remarkable cases have been recorded in which syphilitic children, though remaining in apparently good health, fail to grow up—that is to say, they retain at, say, twenty or twenty-five years the physique and mind of a child of ten.

Of recent years it has become known that syphilitic blood, whether in the congenital or the acquired form of the disease, possesses certain bacteriological properties from which healthy blood is free, and can be identified by a very delicate test known as the *Wassermann reaction*. This test has proved itself of the greatest value in detecting syphilis, even many years after the original infection, and is likely to play a leading part in any measures that may be taken in the near future on a national scale for controlling and extirpating venereal disease.

Treatment.—The drug in widest repute is mercury, administered by the mouth, or rubbed into the skin, or given by subcutaneous injection. Since the discovery of the parasite of the disease, however, a succession of new remedies—containing as a rule mercury or arsenic—have been introduced, though without any proving to be a specific. At present,

however, salvarsan, or "606," is the preparation from which much is hoped, and although opinions vary as to its efficacy, its use has certainly been followed by striking, if temporary, improvement. It may be administered intravenously or into the deeper muscles of the buttock or back, any painful results being minimized by the addition of a local anæsthetic. For tertiary gummata, potassium iodide acts as a specific.

II. Tuberculosis.

This disease, caused by the tubercle bacillus, begins as a local infection, but, unlike many other bacterial diseases, often remains local throughout. On the other hand, the local infection shows a marked tendency to spread locally, destroying more and more of the infected organ, until, finally, it may produce a fatal result on this account.

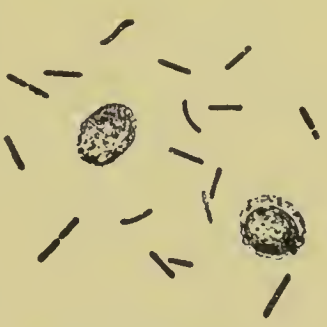

FIG. 7. — TUBERCLE BACILLI.
(Green's "Pathology.")

The bacilli usually gain their entry by one of two routes. Either they are inhaled into the lungs along with particles of dust, or they are swallowed in infected food, especially milk. The bacilli in dust are derived from phthisical patients, who, spitting and coughing, scatter myriads of the bacilli in their sputum and saliva; and as these dry on the floor or in the street, the bacilli become mixed with the dust which, stirred up by wind or traffic, is inhaled into the lungs. In the case of milk the infection is derived from tuberculous cows, particularly those with tuberculous disease of the udder, the process of milking causing tuberculous pus to be squeezed out along with the milk. That this horrible result is a very real danger, not only to bottle-fed infants, but to everyone who drinks milk, is sufficiently attested by an examination

made by the London County Council of the milk arriving at the London termini: one churn in every four contained tuberculous milk.

When inhaled, the bacilli may directly inoculate the lung (setting up phthisis or consumption), or, if swallowed, the intestines (causing tuberculous ulcers). Sometimes, however, without occasioning any recognizable effect on these organs, they may be absorbed in the lymphatics, which conduct them to the nearest lymphatic glands—the bronchial from the lungs, the mesenteric from the intestines—with the result that these become tuberculous. Very frequently the bacilli are absorbed direct from the mouth (perhaps through a decayed tooth or from the tonsils) and carried to the glands in the neck, producing the tuberculous swellings so common in children. Yet another possibility is that a few of the bacilli, passing into the circulation, may settle in some more remote part of the body, such as the brain, spine, or a joint, and there give rise to a local infection. It is not very often that the skin itself is inoculated, but in this event the condition produced is ordinary lupus.

No matter what the site of inoculation, the pathological changes are similar. A little cluster of bacilli become enveloped in a layer of inflammatory tissue, the whole forming a minute speck just visible to the naked eye. These seed-like bodies are known as **miliary tubercles**, from which term, of course, comes the name "tuberculosis." Around the earliest of the tubercles new specimens form, and around these grow others. Thus the infection spreads locally. Finally the more central tubercles soften and form a cheesy pus (caseation). When this occurs in the lung, the pus, escaping into a bronchus, will be coughed up, leaving in its place a cavity where the lung has been ulcerated away. Moreover, if this cavity happens to have formed around a bloodvessel, the latter will remain stretching across from side to side, unsupported by any lung

tissue; and, sooner or later, it will burst, causing hæmoptysis. One further point may be mentioned. Every such ulcerated cavity offers a favourable site for the growth of the septic germs which abound everywhere. A "secondary" infection thus occurs, and the patient is henceforth the subject of a double infection—tuberculous and septic. To the latter, rather than to the tubercle, are attributable many of the symptoms such as the fever.

Sometimes, however, the patient's tissues get the better of the tubercles, and are able, before the damage has gone too far, to deposit around them a casing of chalky material. This ring-fence, as it were, stops the further spread, and the disease is now said to be "healed." Numbers of people—some say the majority—have **healed tubercle** either in their lungs or elsewhere. Nevertheless, although the bacilli are thus encased, they are not killed; and at any time—when, for example, the patient is run down or gets a chill—they may seize their opportunity and start the process once again. Now, however, they often spread with redoubled energy (acute phthisis, or "galloping consumption") and perhaps may quickly become generalized. In this latter event, as we shall now see, the character of the case changes strikingly.

General Tuberculosis is that form of the disease in which the bacilli, having found their way into the blood-stream, are disseminated throughout the body, and cause innumerable tubercles in all parts, but particularly in the brain, lungs, spleen, and kidneys. The condition, of course, is strictly comparable to the generalization of any other infection, and is inevitably fatal. It may occur soon after the initial infection, or not for very many years; in many cases it never occurs. It is more likely to develop in children than adults.

In their symptoms the cases conform to one of three types. (1) The predominant symptoms may be those of

poisoning by tuberculous toxins; and since these toxins produce very similar constitutional effects to the toxins of typhoid, this type is spoken of as the typhoid form. Indeed, in some cases the diagnosis from typhoid fever may, for a while, be a matter of difficulty. (2) Often, however, especially in children, the symptoms are referable to the tubercles which have established themselves in the membranes of the brain; the case then appears as one of tuberculous meningitis. (3) Lastly, when the tubercles are specially thickly scattered through the lungs, the symptoms will be pulmonary—cough, rapid breathing, cyanosis, etc.

CHAPTER XIII

DISEASES OF THE BRAIN

Organic Diseases.

If on account of severe disease the functions of the brain are considerably interfered with, a patient no longer retains his consciousness, but passes into a state of coma. In other cases where the brain is only moderately disturbed, no loss of consciousness will result, but the patient suffers from severe headache, feels giddy and sick, and from time to time becomes convulsed. These effects, including coma, are *general symptoms* of cerebral disease—*i.e.*, they point to the brain as the suffering organ.

But when, instead of the whole brain, some one part of it is affected, symptoms of a different kind are likely to be produced. These will vary with the particular part involved. For example, if the nerve cells receiving impulses from one side of the face are affected, the patient may no longer be able to feel a touch on the cheek of that side; from this symptom the locality of the disease is at once identified. All such symptoms which help in discovering the exact site of the disease are known as *localizing symptoms.*

In actual practice, when proceeding to diagnose a case, the first step is to ascertain what general symptoms point to the brain as the affected organ, and the second is to discover localizing symptoms which will enable the position of the disease in the brain to be mapped out. When this has been

done, a third question presents itself, namely, the precise nature of the disease. This, however, can be answered only from a knowledge of the pathological risks to which the brain is exposed. What are these risks ?

The brain, we find, is encased in bone, and, further, is wrapped round in no fewer than three membranes (meninges), between which there is a layer of fluid (cerebro-spinal fluid), acting as a kind of water-cushion. And yet, in spite of this elaborate protection, the brain has four weak points in its armour, at each of which it is open to the attack of disease: (1) On each side of the head it rests just above the cavity of the ear, separated from it only by a thin sheet of bone, so thin as often to be unable to prevent the spread of infection from the ear below to the brain above. (2) Similarly the front of the brain reposes on the delicate plate of bone which forms the roof of the nose. Here, too, infection may find but little difficulty in ascending from the nose to the brain. (3) The large opening into the spinal canal at the base of the skull affords free communication from the canal to the brain. In point of fact, however, the canal itself is so securely protected by the vertebræ that, except from a neglected bed-sore over the bottom of the spine, infection very rarely gains entry to the canal from without, and therefore only rarely has the opportunity of spreading up to the brain. (4) More important by far is the connection which the brain is compelled to maintain with the outside world through the channel of its arteries. Along these vessels may come at any time infective organisms—spirochætes of syphilis, tubercle bacilli, pneumococci, etc.—which are becoming generalized from a local focus elsewhere. In this way a large number of the cases of brain disease are accounted for.

Keeping these points in mind, we shall now be able to understand most of the pathological changes in the brain, since chief among them are those resulting from infections and from diseases of the bloodvessels. Finally, we must

say a word about two other conditions—cerebral tumours and general paralysis of the insane.

Infections.

1. Infective organisms, on reaching the brain, establish themselves, in the majority of cases, in the meninges, the resulting inflammation being known as **Meningitis.** Of this at least seven varieties are known, but whatever the variety, the *symptoms* are very similar owing to the fact that, in all, the surface of the brain, lying as it does immediately within the meninges, shares in the adjoining inflammation. A patient, therefore, with any form of meningitis, after passing through a period of headache, irritability, and perhaps vomiting, usually sinks gradually into coma—which is, however, often broken by convulsive seizures indicative of the irritation of the brain—and in the end dies. To recognize the particular variety of his infection it is as a rule necessary to examine bacteriologically his cerebro-spinal fluid withdrawn by thrusting a hollow needle into the spinal canal (*lumbar puncture*). In this way we may distinguish the following varieties:

(*a*) *Tuberculous Meningitis.*—This is commonest in children, and shows itself only gradually after several days of headache and peevishness. The patient, steadily becoming more drowsy, lies curled up in bed, and, if disturbed, displays much irritability; but later, after a series of convulsions, passes into a state of profound unconsciousness and complete paralysis. The course of the disease is run in three or four weeks, and invariably ends in death.

(*b*) *Septic Meningitis.*—This may occur at any age, and is most frequently caused by the spread of septic infection from the ear (otorrhœa) or nose, but may also follow a more distant infection—*e.g.*, infective endocarditis. It is always fatal, and its symptoms, though on the whole

resembling those of tuberculous meningitis, are much more acute, lasting only two or three days from start to finish.

(*c*) *Post-Basal Meningitis*, which, as was pointed out earlier (see p. 69), is the sporadic form of cerebro-spinal meningitis, is more particularly a disease of infants under one year; and yet, in spite of the tender age of the patients, it progresses more slowly, and is less often fatal than either of the two first-named varieties. Perhaps its most striking

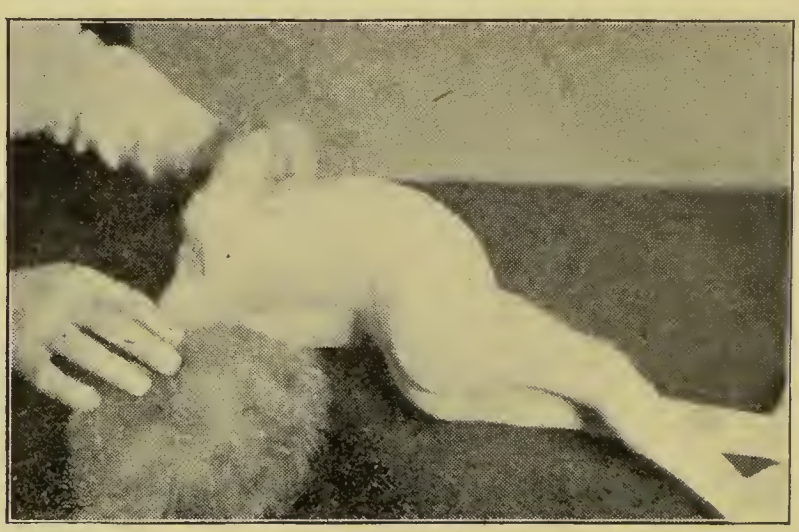

FIG. 8.—POST-BASAL MENINGITIS.
Showing the characteristic retracted head, rigid, arched back, and stiffened legs. From an infant in the Evelina Hospital.

feature is that the head becomes so far drawn backwards as almost to touch the buttocks.

(*d*, *e*, *f*) *Pneumococcal*, *Influenzal*, and *Gonococcal Meningitis* are very similar to, if less acute than, the septic form. They are complications of pneumonia, influenza, and gonorrhœa respectively.

(*g*) *Syphilitic Meningitis*, by no means always fatal, may develop at any time after the generalization of the spirochæte infection. As a rule the inflammation affects the spinal cord even more severely than the brain, but is amenable to antisyphilitic treatment.

2. The infection may lie, not in the meninges, but in the interior of the brain.

(*a*) A localized patch of brain matter may be acutely inflamed—acute **Encephalitis**. This may arise, as we have already learnt, in acute poliomyelitis, the whole condition then being termed "acute polioencephalitis." A local infection, however, is more frequently the result of sepsis in the neighbourhood of the brain, especially in the ear or nose. In these cases the encephalitis usually ends in the formation of a **Cerebral Abscess**.

(*b*) Not uncommonly a tuberculous infection occurs, leading as a rule to caseation. This, however, is a chronic process, with effects which are those rather of a tumour than of inflammation.

(*c*) Similarly in tertiary syphilis a gumma may develop in the brain, the symptoms here again being those of a tumour.

Disease of the Cerebral Vessels.

As I have previously pointed out, cerebral arterio-sclerosis is common as a result of syphilis, and in old age. It is, however, most often found in association with Bright's disease. Once it has developed, the consequences are likely to be serious, owing partly to the fact that a cerebral artery, weakened by disease, finds but little support from the soft, almost jelly-like brain substance in which it lies, and partly from the fact that the brain cells quickly suffer if their blood-supply is interfered with. In any case of arterial disease one of two things may happen. The artery ruptures, and the resulting hæmorrhage forces its way through the surrounding tissue (sometimes the artery first forms a little aneurism, which later bursts with the same result as before), or it becomes thrombosed, and the supply of blood is stopped.

1. **Cerebral Hæmorrhage**, or *Apoplexy*, almost always comes from a certain little artery in the interior of the brain

at a spot called the "internal capsule." It so happens that here the nerve fibres passing *en route* from the brain to the muscles of the opposite side of the body are crowded into a space not much bigger than a threepenny-piece. At this most vulnerable point, therefore, a minimum of hæmorrhage

FIG. 9.—CEREBRAL HÆMORRHAGE.

Showing the brain, its upper half sliced off, with a large hæmorrhage (shaded black), in the left hemisphere, at the site of the internal capsule. From a man who had an apoplectic stroke and died within forty-eight hours.

can inflict a maximum of damage. And, as a matter of fact, the blood, tearing its way through the delicate nerve fibres around, destroys them and causes a paralysis of the opposite half of the body — face, arm, and leg. If the bleeding is really copious, the patient becomes comatose,

and perhaps never comes round again. Even if he recovers, the paralysis is likely to be permanent.

2. **Cerebral Thrombosis** is generally due to syphilis. If arising in a small artery it causes only a limited paralysis—a squint, for example. But on a large scale, when an important artery is involved, the resulting paralysis is correspondingly extensive. Sometimes an arm or a leg, even the whole of one (opposite) side, is paralyzed, while in the severest cases of all the patient passes into coma and never recovers.

3. **Cerebral Embolism** is yet another important affection of the vessels. Most often the embolus comes from a clot or an ulcerating vegetation in the heart; sometimes, however, it breaks away from a mass of clot in an aortic aneurism. Carried to the brain, it plugs one of the arteries, producing instantaneously much the same effects as would occur gradually with thrombosis. If, of course, the embolus is laden with organisms from an infective vegetation, it may inoculate the adjacent brain tissue and in this way cause a cerebral abscess.

Cerebral Tumours.

These grow both in the interior of the brain and at its surface. Whatever their situation, they are likely to set up the five following characteristic symptoms: headache (which is often excruciating), vomiting, giddiness, occasional convulsions, and a progressive loss of sight culminating in total blindness. These general symptoms are explained by the fact that the tumour, as it increases in size, occupies more and more room at the expense of the brain, which, as the skull cannot expand, becomes compressed. In addition a tumour, especially when near the surface, is likely to show localizing symptoms by interfering with the nerves or nerve cells.

General Paralysis of the Insane.

This disease, which we already know as a form of parasyphilis, is a widespread degeneration of the brain affecting first the higher and later the lower centres. At the outset the patient changes in temperament and habits, becoming unusually irritable and neglectful, or too easy-going and extravagant. Then he is filled with delusions of his own importance—physical, social, financial. Next he begins to show a loss of power over his finer movements—his tongue becomes tremulous, his speech thick, his handwriting shaky. This downward course proceeds apace until, in the next stage, his mind begins to fail, his face loses its expression, and his legs and arms become weak. Finally, at the end of a couple of years or so, the paralysis has spread over him, until, demented, bedridden, helpless, he falls a prey to some pulmonary or other infection.

This disease is closely related to tabes (locomotor ataxy). Indeed, parasyphilis, according to whether it affects the brain or the spinal cord, produces general paralysis or tabes respectively. Often, however, it attacks each in turn, so that a case which at the beginning was one of tabes becomes one of general paralysis. Quite recently the living spirochætes of syphilis have been seen in the brain and spinal cord of cases of these diseases, thus furnishing a final link in the chain of evidence connecting tabes and general paralysis with syphilis.

CHAPTER XIV

DISEASES OF THE BRAIN

Functional Diseases.

ALTHOUGH the greater number of cases of functional nervous disease is included under the heading of the psychoneuroses, and as such will be considered later, a not inconsiderable residue stands outside this category. They include cases of, for example, epilepsy, migraine, paralysis agitans, tetany, and occupation neuroses.

Epilepsy—the Falling Sickness of bygone days—is a disease which in its most typical form is characterized by recurrent attacks of unconsciousness, accompanied by convulsions. The seizures, which closely resemble each other, can be divided into four stages. (1) The patient suddenly experiences a preliminary warning, termed an *aura*. Sometimes it is a flash of light before the eyes, or a noise in the head, or an evil smell. In other cases the face, or tongue, or a limb tingles; or they begin to twitch and cannot be controlled; or the patient feels giddy, or flushed, or chilled. The aura is almost momentary, and (2) the patient drops to the ground as if shot, perhaps uttering a cry or groan (the epileptic cry) as he falls. He is at once completely insensible, and his body and limbs go stiff from the contraction of the muscles. For the moment his face is pale, but, with the muscles of respiration stopped, the want of oxygen shows itself in the growing duskiness of his lips, which

soon deepens to a blackish hue, overspreading the whole face, fingers, etc. This *tonic stage* (tonic implies a continued muscular contraction), is over in half a minute or so, and (3) the patient begins to be convulsed. At first his face and head twitch, but soon all the muscles of the body are in violent and rapid contraction. The tongue quickly churns the saliva to a froth—perhaps blood-stained if the tongue gets caught between the teeth—the face looks black and bloated, the breathing is difficult and noisy, while even the bladder and rectum may contract, expelling the urine and fæces. This is the *clonic stage* (from "clonus," an interrupted contraction). All this while the patient remains unconscious. (4) At the end of not more than five or six minutes the tumult gradually subsides. The breathing becomes easier, and, with the better aëration of the blood, the dusky colour fades, leaving the face pallid once more. Soon the patient is lying quite still, but so deeply unconscious that if his eye is touched with the finger he does not blink. Finally, the coma lightens, and the patient passes into what looks like natural slumber. On waking he finds himself dazed and confused, cannot remember what has happened, and probably complains of a violent headache, which he is glad to have the opportunity of sleeping off.

This is "major" epilepsy or **haut mal.** "Minor" epilepsy or **petit mal** is a much less exhausting affair. The patient, perhaps in the middle of conversation, suddenly loses himself. He does not fall, but stands or sits quite still as he was, his eyes fixed and seeing nothing. In a few seconds he comes to again; he may seem confused for the moment, but quickly picks up the thread of his talk, maybe never realizing that anything has happened.

Either of these two forms of epilepsy may be followed by the curious, but serious, mental condition known as the *post-epileptic condition.* The patient remains as in a trance, and though able to walk and do things, acts like an automaton,

with no consciousness of his deeds. The seriousness of the condition lies in this, that while in the state he may be impelled by homicidal impulses to attack and even murder anyone who happens to be near. Apart from this danger, however, there are only two risks attaching to epilepsy. The patient may injure himself as he falls—perhaps against the kerb or in the fire—but rarely fatally, unless by chance he falls in front of a train or vehicle. Or he may be drowned by falling into the water—even a puddle may be deep enough, provided it covers his mouth and nose. The other risk is the progressive mental deterioration which may follow in the wake of the disease, finally dragging down the patient to a level of imbecility.

The pathology of the disease has already been briefly indicated (see p. 11), but a few additional points must be given. The cerebral nerve cells which control muscular movements are collected together at an area—the Rolandic area—on the surface of each hemisphere of the brain. If this area is stimulated artificially, say by an electric current, convulsive movements begin over the whole of the opposite side of the body. If, however, the stimulus is applied to different parts of the area in turn, the convulsions will now be limited to the arm or the leg or the side of the face. Epilepsy, therefore, would appear to be a disease caused by some pathological stimulation or irritation of the whole Rolandic areas; but the nature of this irritation remains unknown. On this account the disease must, for the present at least, be called "functional."

On the other hand, it is important to know that in some cases with epileptic convulsions a definite organic cause is responsible, and if this is properly treated, the fits can be abolished. Thus a tumour which happens to press on the Rolandic area will cause epileptic convulsions, and yet after treatment by drugs or by operation, the patient may recover. Often, however, in these cases the patient, although con-

vulsed, may retain his consciousness, the attack being known as *Jacksonian epilepsy*, after Dr. Hughlings Jackson who first described it. In other cases, again, an epileptic seizure indistinguishable from haut mal may occur as a part of Bright's disease (uræmia). None of these organic conditions, however suggestive the fits themselves, is entitled to pass as genuine epilepsy. In fact, to accentuate their distinction, the convulsions in Bright's disease and cerebral tumour are better styled *epileptiform*.

But even with these put on one side the genuine epileptic has still to be distinguished from the patient in an hysterical fit, and from the malingerer. The hysterical patient (usually a woman) is to be known by the following points. She takes care when she falls to do herself no injury. She never becomes cyanosed, bites her tongue, or passes water. If an onlooker attempts to hold her down, her struggles seem almost purposely directed to liberate herself. And the fit lasts not for minutes, but for hours. The malingerer—a not infrequent visitant to hospital casualty departments when he is looking for a night's lodging—never loses consciousness, as is easily proved by touching his eye to make him blink, while his efforts to "fake" a convulsion make him so hot that his face, instead of being pale and dusky, becomes flushed and perspiring. He may, however, foam at the lips —with the help, that is to say, of a little soap hidden in his mouth.

Migraine, or sick headache, a very common affection, consists of periodic attacks which, like epilepsy, are due to a disturbance of nerve cells at the surface of the brain. In migraine, however, the cells are those lying some way behind the Rolandic area, being at the back or occipital part of the brain, where the centre for sight is located. Consequently the migrainous attack consists primarily of a visual disturbance; it is, if the expression be permitted, an epileptic convulsion of the sight area.

The patient first notices that the centre of her sight becomes blind, so that, looking at a book, she can see the whole of the page of print except the exact word she looks at; at this spot she seems to see only a moving mass of bright light. Soon the blindness, and with it the surging light, begins to spread over the eyes, but at the same time the sight begins to return in the centre again. Now she can see the word she looks at, but not the words around, though she can still see the print towards the margin of the page. In half an hour or so the blindness has worked to the edge of the sight, with a growing area of clear vision returning in the centre. The whole of the page is now visible except its extreme limits. Finally even this clears, and the attack, so far as the visual disturbance is concerned, is at an end. But the most distressing part is yet to come. About the time the sight recovers itself a headache begins, often on both sides of the head, but sometimes curiously limited to one side only. At first it may not be very severe, but it becomes rapidly aggravated, and before long is of an intense "splitting" character, and probably lasts for twelve hours, twenty-four hours, or even longer, the patient meanwhile lying quite incapacitated, but impelled by its severity to vomit from time to time.

This disease occurs even in young children, but is common in early adult life, especially in women, in whom it is often associated with menstrual troubles. Other ætiological factors are prolonged eye-strain — "theatre-headaches," over-study, etc.—especially if the sight is not quite perfect, mental worry and fatigue, and constipation. In the treatment of the attacks various drugs have proved of service in different cases, but the most trustworthy are phenazone, phenacetin, and potassium bromide.

The features of **Paralysis Agitans** are well summed up in its popular name, the "shaking palsy." It shows itself first in the arms by incessant shaking movements, five or

six a second, which spread later to the legs, and perhaps to the head. At the same time the muscles become weak, and later still grow stiff. This stiffness is responsible for a bodily attitude of the patient when walking which is characteristic of the disease. With the trunk inclining forward at the hips, the head bowed, the arms held close to the sides, but with the elbows bent, carrying the hands forwards, the patient totters along with short, feeble, almost fussy steps, which tend to get quicker and quicker as though to save him from tumbling forwards. Another curious feature is that the patient, if started off backwards, is unable to stop until he falls or runs against an obstacle.

The disease particularly affects the aged, and is, indeed, to be regarded merely as an exaggeration of the normal tremulousness of old age. It runs a very slow course, taking many years to unfold itself, and, though incurable, is not inimicable to life.

In **Tetany** the patient suffers from recurrent attacks of muscular spasm. Throughout the paroxysm the fingers are tightly crowded together at their tips, with the thumb pressed into the palm. The toes are similarly contracted, and all the limbs are held rigid. This spasm, which may be accompanied with cramp, lasts from a few minutes to several days, and can be restarted merely by tapping or pressing on the nerves to the limbs. It is almost certainly caused by some poison or poisons at present unidentified, which, however, are possibly absorbed from the alimentary canal. It is particularly common in babies with rickets or gastro-intestinal disorders; but it is also seen in adults with dilatation of the stomach, and in pregnant or lactating women. Some cases occur after operations on the thyroid gland. The result may be fatal, but only rarely; on the other hand, the cramp may be so severe as to call for relief by chloroform or other anæsthetic.

Occupation Neuroses. — This term is applied to a

number of functional nervous diseases which arise in connection with occupations in which frequent use is made of the little muscles of the fingers. One of the best-known examples is **Writer's Cramp**, which occurs in clerks and authors. The fingers, instead of grasping the pen lightly, pass into a spasm, often accompanied by neuralgic cramp, which prevents, or at any rate impedes, any further work. A comparable condition is met with in typists, telegraphists, pianists, violinists, and cigarette-rollers.

These neuroses are serious in that they may deprive a worker of his livelihood, and for this reason they should be treated at an early stage. Temporary rest for the muscles is essential, and should be supplemented by massage and electricity. Often, however, more can be done by investigating the exact muscles employed when the hand is working, and devising some alternative anatomical arrangement whereby the strain is distributed over other muscles which hitherto have not been in use.

CHAPTER XV

DISEASES OF THE SPINAL CORD AND NERVES

The spinal cord, which runs in the vertebral column from the brain to a level a little below the last rib, receives and gives off, at regular intervals all the way down, the nerves from and to every part of the body. One of its chief functions is to convey to the brain all sensory impulses coming in along the nerves, and to transmit from the brain all motor impulses intended for the muscles. It consists of nerve fibres and nerve cells. Those of its nerve fibres which convey incoming messages are known as *ascending* fibres; the others, bringing motor impulses down from the brain, are *descending* fibres. In addition, the cord, thanks to its nerve cells, which here, as in the brain, imply the power of initiating impulses, acts as an under-brain, doing in an automatic fashion the humbler and simpler work with which the brain itself need not be troubled.

Nevertheless, its nerve cells are closely watched over by the brain. To them run the descending motor fibres from the brain (which we must now know under their proper name of *pyramidal fibres*), and from them issue a fresh relay of fibres which pass out as nerves to the muscles of the body. Taken altogether, therefore, the cord may be pictured as an intricate system of telegraph wires (nerve fibres) and local telegraphists (nerve cells), and it can be thrown into disorder in one of three ways. Either the incoming

wires (ascending sensory fibres to the brain) may be injured, or the outgoing (descending motor fibres) may be interrupted, or the local telegraphists themselves (nerve cells) may fail.

When any of the Ascending Fibres are diseased and are no longer capable of carrying impulses, the brain is cut off from incoming messages from a corresponding part of the body. The patient is therefore unable to feel a touch on that part of his skin, and is said to be *anæsthetic* in that part. If he fails to feel pain, he is *analgesic* (algesia = pain); and if without sense of heat and cold, *thermo-anæsthetic*. In milder cases, however, when the impulses just manage to get through to the brain, though much enfeebled, the patient feels his skin numbed—*paræsthetic*. Further, the gradual degeneration of the fibres often causes impulses to be originated at the site of the disease in the cord, and these, passing up to the brain, are received unquestioningly as having come all the way from the skin or muscles. The patient therefore thinks he feels darting pains in his legs, or his fingers tingling, and so on. Yet another consequence of ascending degeneration must be noted. In the act of standing or walking—highly complicated efforts in balancing—we rely on, among other helps, the sense of pressure on the soles of the feet. If, therefore, this assistance is lost by spinal disease holding back the pressure impulses from reaching the brain, difficulty will be experienced in standing, and on trying to walk the feet will be jerked about irregularly. This peculiar gait is known as *ataxy*.

Now let us consider **Degeneration of the Descending (Pyramidal) Fibres.** When this occurs, the only route by which the brain can get its messages to the spinal cells and thence to the muscles is blocked. What is the result? Paralysis, or, at the least, loss of cerebral control over the limbs. But let us look a little more closely into this. These pyramidal fibres come, some from the right half of

the brain, the others from the left, and the two sets—"tracts" they are called—cross each other at the top part of the cord known as the "bulb," the tract from the right half of the brain running down in the left half of the cord, and *vice versa*. Here they end, as we have learnt, at the spinal nerve cells. Now, some of these cells, high in the cord, control the arms; others, lower down, control the legs. Consequently, if both pyramidal tracts degenerate high up, both arms and both legs will suffer; if the degeneration is low down, the arms will escape, the legs alone suffering.* When the degeneration is not enough to produce complete paralysis, the patient finds he can still move his limbs, but it is very hard work, especially as his muscles inevitably become more and more rigid.

Thirdly, **the delicate Spinal Nerve Cells, if diseased** at all, are generally destroyed altogether, and their functions cease, both in relaying motor impulses coming from the brain by the pyramidal tracts, and in automatic action. The muscles, therefore, which depend on the affected cells are completely paralyzed, and they waste (*atrophy*).

From the foregoing it will be plain that the symptoms of any spinal cord disease will be determined, first, by the structures which degenerate in the cord—whether ascending or descending fibres, or nerve cells—and, secondly, by the level at which the cord is attacked—whether high or low. If, therefore, in passing in rapid survey the most important spinal cord diseases, we learn the position of the degeneration, we shall be able to deduce the symptoms for ourselves.

* In spinal cord disease both tracts are as a rule affected together. If one alone is involved, the disease probably lies in the brain—as in apoplexy, which, as we saw earlier, destroys this tract as it crowds through the internal capsule, and before it has crossed at the bulb to the opposite side.

Chronic Spinal Degeneration.

Progressive Muscular Atrophy.—This is a slow degeneration of the nerve cells controlling the hand muscles and the arms generally. The only symptom, therefore, will be a progressive paralysis and atrophy of the little muscles in the hand, which spread gradually to the shoulders.* Occasionally the degeneration affects the cells in the highest part of the cord—the bulb—which controls the muscles of the mouth and throat, the paralysis then showing itself in the patient's speech and swallowing (**Bulbar Paralysis**).

FIG. 10.—PROGRESSIVE MUSCULAR ATROPHY.

Note the wasting of the muscles of the hand, especially of the ball of the thumb (From Starr's "Nervous Diseases." After Dercum.)

Spastic Paraplegia.—Here both pyramidal tracts degenerate in their lower extent. Its symptoms, therefore, are loss of power in walking and stiffness of the legs.

Amyotrophic Lateral Sclerosis.—The parts to suffer in this instance are the spinal cells *plus* the pyramidal tracts. The symptoms, therefore, will be those of progressive muscular atrophy *plus* spastic paraplegia.

Tabes (Locomotor Ataxy), which has been referred to more than once in earlier pages, is a degeneration of the

* It will be noticed that this disease is, as a chronic change, what poliomyelitis is as an acute.

ascending fibres, especially those from the legs. The symptoms, therefore, include darting pains in the legs ("lightning-pains"), and anæsthesia, particularly of the soles of the feet, thus causing ataxy and unsteadiness in standing. In addition, some degenerations occur in the brain (you will recall the connection between tabes and general paralysis), as a result of which the pupils of the eyes fail to move when a bright light is thrown against them (Argyll-Robertson pupil). Further, tabetic patients often develop squints, and sometimes lose their sight from atrophy of the optic nerve.

All the above are very chronic affections, and, though progressive, last for many years. Little is known of their causes—except in the case of tabes—and therefore the treatment must be directed rather to the relief of their symptoms than to the cure of the disease.

Disseminated Sclerosis. — Occasionally patches of chronic degeneration (sclerosis) are scattered, or disseminated, up and down the cord, some, indeed, getting as high as the brain. The symptoms, therefore, are partly spinal, partly cerebral. They are a marked tremulousness of the limbs, especially when the patient's attention is drawn to them; a jerky habit of speech ("staccato" speech); and an incessant rolling of the eyeballs (nystagmus).

Spinal Compression.—This condition results when the cord is pressed on by some growth from without. This may be a cancer, or an abscess in spinal caries; but often it is an aortic aneurism, which, having eaten its way through the vertebræ, presses against the cord. In each instance the cord gets nipped against the bony spine, and all its three functions are affected.

We now come to two groups of spinal diseases which, though their symptoms are governed by the same factors as before, are more or less acute in their onset. These are Infections and spinal arterial disease causing Thrombosis.

Infections.

These are usually brought by way of the circulation, and, as in the brain, attack either the meninges or the interior of the cord.

Spinal Meningitis.—The same varieties occur here as in the brain, but, owing to the fact that the cerebral meninges are almost always infected at the same time as the spinal, the symptoms are those rather of cerebral than of spinal meningitis, and on this account they need not detain us again—except to emphasize that a bedsore, especially if neglected, may set up septic spinal meningitis, which generally spreads to the brain.

Myelitis.—This occurs in two forms, the first of which we already know: (1) *Acute Poliomyelitis* affects the spinal nerve cells. Like other inflammations, it begins with feverishness, but, after one or two days, the child's limbs are seen to be paralyzed. Though an improvement is often noticeable at the end of the week, some permanent paralysis usually remains, and the limb, always cold and blue, fails to grow like its fellow (see also p. 67). (2) *Transverse Myelitis* is an infective inflammation which spreads transversely across the cord, usually about the middle of its length, injuring everything—ascending fibres, descending fibres, and nerve cells alike. As a result, the patient becomes rapidly paralyzed in both legs and up to the waist, is anæsthetic, analgesic, and thermo-anæsthetic over the same extent. Important results follow. With all ascending sensations cut off from the brain, the patient is no longer cognizant of the state of either bladder or rectum, and incontinence is the penalty. Even the uterus may act independently, as in the case of a pregnant patient, whose confinement passed successfully through all its stages without the mother feeling a twinge of a labour pain, or, indeed, knowing, except for what she was told, that labour was in progress.

Spinal Thrombosis.

This, like cerebral thrombosis, is generally due to syphilitic arterial disease, but in old people may depend on senile arterio-sclerosis. It usually spreads through the whole thickness of the cord at the level of the diseased artery. In other words, the nerve cells and all the fibres, up and down, suffer at that one level, and the sum effect will be not unlike that of transverse myelitis. Still, the prognosis is more hopeful since antisyphilitic remedies may completely cure the condition.

Neuritis.

Just a word may be added in explanation of the only common disease of the nerves—neuritis. Its most important form is that in which many, if not most, of the nerves are affected simultaneously (**Multiple Neuritis**), and it will be obvious that the cause, whatever its nature, must, since it operates all over the body at once, be in the blood. And, as a matter of fact, the disease is the result of a poison in the blood. In many cases this is alcohol, whether imbibed as beer or spirits ; but in others is lead or arsenic. Multiple neuritis, however, is common as an effect of bacterial toxins, especially in diphtheria, influenza, typhoid, and septic infections. It is also associated with gout and other obscure diseases. As to its symptoms, since almost every nerve contains both sensory and motor fibres, they may be partly sensory (pain, anæsthesia, etc.), partly muscular (paralysis). In a fully developed case the patient may be paralyzed hand and foot, and if, as often happens with alcoholic neuritis, the brain itself is poisoned, may suffer from delusions or even be maniacal. The essential preliminary to treatment is to identify the poison and to exclude it from reaching the patient.

It is of interest to add that a tropical form of neuritis, known as *beri-beri*, has recently been shown to depend, not on the presence of any toxin in the blood, but on the absence of some essential constituent of diet. Beri-beri, which is common among the rice-eating Asiatics, attacks only those who subsist on "white" rice—*i.e.*, rice from which the husks have been removed by milling—whereas the natives who eat "whole"—*i.e.*, unmilled—rice never develop the disease. A striking illustration of this difference is provided by the Singapore prison where, in 1902, when white rice was still given to the prisoners, half of them suffered from beri-beri, but in 1907 and 1908 when only whole rice was used, not a single case of the disease occurred.

CHAPTER XVI

HYSTERIA AND OTHER PSYCHO-NEUROSES

We come now to a subject which is of the first importance, and which, by bringing us close to the springheads of human motive and desire, can hardly fail to be of interest to everyone who is interested in the workings of the human mind and in the relation between mind and body. Our understanding of hysteria has taken, within the last few years, a great stride forward, and stands to-day where we can, for the first time, discern the essential nature of the disease clearly enough to effect its cure by a reasoned, scientific method which has little in common with the haphazard, uncertain "moral" treatment of yesterday.

The subject, however, is complex. Its outline will be best appreciated by regarding it, in the first instance, from a distance. As a starting-point let us consider the normal working of the human mind. For, be it noted, mental processes are governed by natural laws just as are the activities of the lungs or kidneys. And just as, if the normal actions of a bodily organ are interfered with, bodily disease is the penalty, so the natural laws governing the activity of the mind can be offended against only at the risk of mental disease.

That special branch of physiology which deals with the mind is called "psychology," and has to-day made so accurate a survey of its special ground as to enable our mental processes to be followed as accurately as the working of our

bodily organs. These mental processes, when analyzed, will be found to be made up of *ideas*, or, in ordinary parlance, thoughts. We think of, for example, a pigeon, with the result that there rises in the mind an "idea" of a pigeon. This idea is itself composed of sensations which have been received on previous occasions along our nerves when we paid attention to pigeons. Some of these sensations will have come in through the eye (the pigeon's colour, size, shape), others through the ear (its cooing), others through the sense of touch (its size again, its softness, and smoothness). In the same way, every idea can be analyzed into sensations which are themselves dependent on the stimulation of sensory nerves. On these lines, therefore, the bedrock foundation of mind is sensation through sensory nerves.

Now, one of the chief laws of mental action is that every fresh idea entering the mind must attach itself to somewhat similar ideas already present in the mind. Thus if we, already possessing the idea "pigeon," see a ringdove for the first time, the "ringdove" idea would, in obedience to the law, attach itself closely to the "pigeon" idea, less closely to, say, a "blackbird" idea, and not at all to anything so dissimilar as, for instance, a "cupboard" idea. In other words, ideas become sorted out and joined together according to their resemblances, first to those which have preceded them, subsequently to those coming in later.

This power of *association* is of great importance. In the first place (using the same illustration as before), there is so much in common between the ringdove and pigeon ideas, and so little between the ringdove and cupboard ideas, that it is hardly possible to compel the former to keep apart or the latter to come together. Secondly, each idea rising before the mind inevitably brings with it a train of associated ideas. In fact, the ordinary thinking that goes on in our

heads is a procession of associated ideas, one leading to another. To give an example. I jump into a bus and see opposite me a youth wearing light blue socks (first idea). At once his socks put me in mind of Tomkins, who affects the same colour (second idea). That reminds me that the last time I saw Tomkins was on the platform at Dorking (third idea). Ah, yes, that was the day I had been down to see Robinson (fourth idea). I wonder if Robinson's little girl has got over her accident (fifth idea). Horribly unsafe these spirit-lamps are (sixth idea)! And so on. Within a few moments, therefore, the blue-socks idea has led, by association, to the idea of spirit-lamp explosions.

It is, of course, this property of ideas to hang together which makes recollection and memory possible. When we "try to recall" something or other, we try to get hold of one end of a chain of ideas which will lead to the desired idea at the far end. Similarly, having been told something new which we are particularly anxious to remember, we make a special effort to "fix" it in our minds by associating the new idea with older, familiar ideas in the expectation that by recalling these later on, the new idea will be brought out along with them.

But now we must go a step further to another psychological law by which every idea entering or rising in the mind brings with it an atmosphere of *feeling*. Thus we think of a rose or a snake, and at the same moment the idea is enveloped in feeling—pleasant in the one instance, unpleasant in the other. The amount and intensity of the feeling, or *affect*, as psychologists call it, varies with the idea. "Child," "mother," "lover," are ideas richly endowed with affects; indeed, the strongest affects are those dependent on sexual ideas—using this term in its widest sense to include not only procreation, but maternal and filial love and all the other higher feelings that rest on

the foundation of the sexual instinct. Further, an affect which is very vivid is called an "emotion." And emotions, it must be particularly noted, though mental, are connected with striking bodily changes; when pleasant (joy, for example) they quicken the breathing and the heart-beat, and greatly increase the muscular power and energy; when unpleasant (fear, for example) they blanch the face, arrest the breathing, make the skin cold with sweat, and the limbs tremble. The stronger emotions are always short-lived, but the weaker may persist for some length of time, and are then called "moods"; thus the emotion of grief becomes the mood of depression, the emotion of joy the mood of cheerfulness.

At this stage it is desirable to emphasize three facts arising out of the foregoing, which are of great importance to the understanding of hysteria. The first is that an idea inevitably implies feeling or affect; it is no more possible for the one to exist without the other than for the sky to be without its blueness. The second is that an idea cannot be called up from memory without its feeling coming with it. And the third is that Nature does not permit feeling to be ignored or suppressed; it must be allowed an outlet somehow.

From time to time, however, ideas (with their feelings) which are unpleasant or distasteful, and which we would prefer not to entertain, thrust themselves into our heads. What happens in these cases? The ideas themselves we can put out of our minds; we refuse to think about them. But what is to be done with the feelings? To attempt to repress them—to "hide" our feelings—is an undertaking of no little difficulty, and, if the feeling is strong, can hardly be done. The truth is that feelings well up from so deep a level in our nature, from the primal strata of ourselves, that to deny them expression is to set ourselves athwart the path of one of the most elemental, and therefore most

powerful, psychological laws. Nevertheless, the suppression of feeling can be attempted; sometimes, indeed, either because of social necessity or in order to preserve our pride and self-respect, it *must* be attempted. But only at a cost. And at what cost will be seen when I explain the onset of hysteria.

Before coming to this, however, there is just one other psychical matter to be made clear, and that is with reference to consciousness and subconsciousness. What are we to understand by *consciousness?* It may be regarded as the mental processes which make up our experience at any given moment of time. Your own consciousness at this moment, as you read these words, includes not only the subject we are discussing, but also ideas of a printed page, this book, feelings of assent or dissent connected with what you have just been reading, of familiarity or novelty according to whether or not you knew it before, sensations of pressure of your chair against your skin, a sense of the things around you in your room, the ticking of the clock, noises outside, etc. All these go to make up your consciousness *now*. An hour hence, however, every one of these items may be absent from your consciousness, their place then being taken by ideas, sensations, and feelings associated with, perhaps, the bustle of a railway-station. Nevertheless, at that time, this book, your room, etc., though displaced from your consciousness, will not have been excluded from your mind altogether, but will have been relegated to your *subconsciousness*, whence the reminiscences can be called up at any time. While, therefore, consciousness includes only what is in mental use at the moment, subconsciousness is a great storehouse of the accumulated experiences of years, to which new additions are being made every hour and every minute. Moreover (though this may sound extraordinary), these memories, however dusty with time and overlaid with heaps of more

recent memories, will, if brought out by special methods into consciousness, even after twenty or thirty years, be found as fresh and clear in their details as in the very hour they were stored away. This phenomenon has been proved by, and, indeed, forms the basis of, the treatment of the psycho-neuroses which will be described later.

Consciousness, however, does not occupy the mental stage continuously, but retires at intervals. This is the case, of course, during sleep, but it also occurs during waking hours. At these times the subconscious memories, finding the stage deserted, may take the opportunity to occupy it themselves, with dreams in the one case, with day-dreams and reveries in the other. The memories thus emerging are invariably those which are reinforced by powerful feelings, whether pleasant or unpleasant. In fact, dreams and reveries, psychologically investigated, furnish infallible evidence of the underlying desires, ambitions, and fears in the patient's mind, and for this reason are of no small value in elucidating cases of hysteria.

Thus far I have dealt with the psychology of normal individuals, but the same mechanism of thought and feeling operates in everyone. Only this, however, must be added: that in any individual in whom, for one reason or another, the natural mechanism is interfered with or obstructed, a psychical derangement is the penalty. Unfortunately, many men and women, never having been instructed in mental science, and understanding little of the workings of their own minds, find themselves confronted with desires and fears, the results of natural processes of which they know nothing, and which, on this very account, loom all the more intimidatingly before their imaginations. They have to struggle with thoughts and feelings which, being natural, cannot be thrust aside as of no account, and yet seem to impel them along paths which they would elect not to tread; and out of the heat and fatigue of the conflict come anxieties,

worries, self-depreciation, and self-mistrust. Those who are able to face these problems frankly and honestly gain the mastery over their thoughts and feelings, and with it peace of mind. But there are others who, on the one hand, and by a great effort, deny a natural outlet to their feelings, and yet, on the other hand, pretend to themselves that the feelings do not exist. These people endeavour to escape from the horns of their self-made dilemma, and yet still to preserve their normal attitude towards our social life, but they gain their end only at the cost of hysteria or some other psycho-neurosis.

Our next step, therefore, must be to inquire how these changes are brought about by this *repression of feeling*. Thanks to the work of Professor Freud, we have gained during the past few years an insight into these disorders which has gone far to make their treatment a matter of precise scientific practice.

At the outset it should be realized that hysteria is protean in its variety. The severest types, such as paralysis, anæsthesia, fits, catalepsy, trances, represent the more complex forms, and are comparatively infrequent in this country. But the milder types are very common, the symptoms, which range over a wide field, including the following: loss of voice, cough, hiccough; rapid pulse, palpitation, giddiness; vomiting, flatulence, indigestion, extreme distaste for food, œsophageal obstruction; headaches, shaking movements of the head, wry-neck, jaw-spasm, paralysis of the eyelids, tremulous movements of the arms, contractures. The psychological mechanism responsible for these cases has already been hinted at, but must now be examined more closely.

The mental processes of a psycho-neurotic patient, though rather richly coloured with emotions, run on more or less ordinary lines subject only to the restraints which are binding on us all. A time comes, however, when his conscious-

ness is invaded by some wish or desire which demands gratification. Within the bounds of mental health one of two courses must be followed. Either the desire is acknowledged in consciousness (*i.e.*, the patient admits it to himself), and it is allowed its natural gratification; or, still being acknowledged in consciousness, it is submitted to critical examination by the patient's ethical and religious opinions, under which scrutiny it evaporates (*i.e.*, is got under control).

A third course, however, morbid and unhealthy, is possible. The patient, instead of dealing frankly with the desire, gratifying it, or, alternatively, putting it out of his mind, follows the ostrich-like plan of pretending it is not there. On the one hand, he cannot harmonize its gratification with his common sense or his self-respect, and yet, on the other hand, he weakly indulges its presence for the pleasure it gives him. He feels he ought to put it out of his mind, but, instead, he takes a morbid satisfaction in playing with it. The result is to make him uneasy, annoyed, worried, and the desire, beginning to chafe and irritate his mind like a foreign body, finally becomes unbearable.

At this critical juncture the patient, by an ingenious disruption of his normal psychical processes, successfully liberates himself from the unbearable idea, while at the same time securing to himself the same mental satisfaction as if the desire had, in fact, been realized. The mechanism employed is to tear apart the idea from its affect, and to deal with each separately. The idea, now weakened by the loss of its effect, is thrust down into subconsciousness; the patient no longer thinks about it. The affect, too strong to be thus easily got rid of, is converted into a bodily equivalent—headache, contracture, etc.—which henceforth stands as the hysterical symptom. However painful this new symptom, it is at any rate less painful to the patient than the desire he has now got rid of. Moreover, the removal

of the foreign body from his consciousness is followed by the same mental calm as if the desire had been gratified. Consequently, the hysterical symptom represents to him the symbolic expression of the realization of the desire, and therefore, far from being disliked by him, is a source of satisfaction. It has, indeed, a bitter-sweet flavour which makes him not at all willing to part with it ; and, as is well known, hysterical patients are quite happy not to be made well.

This psychological mechanism may be illustrated by the case, recorded by Freud, of Miss Lucy R., an English governess in a Viennese family. The mother of the family had recently died, but not before obtaining a promise from the governess (a distant relative) always to look after her little ones. The symptom bringing the patient under medical observation was a distressing subjective sensation of a smell which she said resembled burnt pastry. On analysis of her subconsciousness (see p. 123) it was ascertained that the smell dated back to an occasion when the governess, persuading herself that the household servants were intriguing against her, had, in spite of her promise to the mother, given notice to leave to the father. At that time, so she recalled, some pastry which the children were cooking in the schoolroom became burnt. This explanation, while sufficiently accounting for the peculiar symptom, was not at all conclusive in solving the main question why giving notice should have by itself occasioned feelings so strong as, when repressed, to cause hysteria. The patient herself wished to explain it by her unhappiness at leaving the children ; but the real cause evidently lay deeper, and the analysis was continued. From this it appeared that the father, a very reserved man, had on one occasion, after his wife's death, discussed with the governess the future of his children, and while speaking had used towards her what she regarded as a significant kindness of tone and

look. At all events, the conversation, rapidly filling her mind with pleasing fancies, resulted in her falling in love with him. No other confidential talk followed, however, and the patient, annoyed at her weakness towards one who was her employer, and seeing herself a poor girl and him a rich man, found her desire intolerable to her self-respect. The psychological course which she thereupon followed was the unhealthy one of refusing to admit to herself that she was in love. "I did not know it," she explained in her analysis, "or, rather, I did not wish to know it. I wished to crowd it out of my mind, never to think of it again, and of late I have been successful." (In passing, we may note that this description of the mechanism causing hysteria could hardly be bettered.) The psychical injury dated, it is true, to the time when she gave notice; but the hysteria was caused, not by her feelings towards the children, nor by breaking her promise to the mother, but by her feelings towards the father. On acknowledging this, and on further realizing that the father's tone and expression had no doubt been kindled by thoughts of his dead wife, the patient found no real difficulty in taking a healthy view of the whole position, and her hysterical symptom vanished.

As in the above, so in all cases circumstances of one kind or another make the desire impossible of realization. Thus, when a mother has died, her favourite daughter's desire to undo the handiwork of death may be intense—and yet how can it be gratified? In another case the patient may have felt a strong attraction for a friend already married; but here again, having regard to the patient's ethical and religious standards, the desire may be equally unattainable. Yet again, an extreme fright may cause an intense desire to escape, which, however, cannot be gratified on account of the simultaneous paralysis of all power of motion. Here we have three psychical injuries likely to produce hysteria.

To sum up, hysteria represents a defence on the part of the patient against a strain heavier than the mind can bear. It implies the suppression of a desire, and the conversion of its psychical feelings into a bodily equivalent. The mental relief secured by this conversion expresses to the patient the same relief as if the desire had, in fact, been gratified. The hysterical symptom, therefore, symbolizes this gratification, and on this very account becomes a source of satisfaction to the patient.

Nevertheless, for all this successful defence the idea itself still lurks in subconsciousness, whence it will try from time to time to thrust itself up into consciousness and reclaim its natural affect. In dreams and reveries, therefore, it will come into its own; in fact, dreams will commonly be found, on analysis, to represent the gratification of a repressed desire. Further, at times when some incident in the patient's daily round tends to provoke the original desire, the conflict with the natural psychical process is renewed, and an hysterical outburst, or a return or an aggravation of the hysterical symptom, is now, as before, the means of defence and escape.

The foregoing mechanism also makes clear the nature of two other classes of psycho-neuroses—namely, obsessions and phobies. An *obsession* is a "fixed idea"—a man, for instance, finds himself compelled to walk only on the cracks in the pavement; or a mother, whenever she takes a knife in her hand, feels impelled to cut the throats of her children, whom, nevertheless, she loves. The *phobies* are those common conditions in which patients become slaves to a horror of this, that, or the other thing—horror of open spaces, horror of closed spaces, horror of railway travelling, horror of falling over precipices, horror of darkness, etc. In all these cases the mechanism is the same as in hysteria, but the final result is different in that the detached affect, instead of being converted into a bodily equivalent, becomes

tied on to another quite bearable idea in consciousness. This neutral idea, now endowed with an unnaturally rich affect, henceforth insistently obtrudes itself on the patient's notice as an obsession or phoby, while the original unbearable idea, weakened and made innocuous by the loss of its affect, is dismissed into subconsciousness.

The Treatment of Psycho-Neuroses.

Freud's theories are strikingly confirmed by their success when applied as the basis of a method of treatment. On this basis the aim of treatment is clear. The patient is suffering the result of obstructing a natural psychical process; the remedy is to lead back his mind to the occasion of this injury, to reawaken the original desire with its affects, and to force these on his attention, compelling him by conversation and argument to acknowledge them in his consciousness. The cause of the disorder is thus removed, and the patient is cured.

This treatment is known as *psycho-analysis*. Though its purpose is to uncover the foreign body, the patient, by the very nature of the case, refuses to be anything but ignorant of the cause of his trouble, and does his best to keep it buried. The analysis, therefore, begins by the application of special psychological tests which speedily indicate the direction in which the suppressed idea is to be found. The physician then enables the patient to revive all subconscious memories bearing on the cause, digging, as it were, layer by layer through the accumulations of his memory. The nearer the approach to the repressed idea, the stronger the resistance shown by the patient against reviving his unpleasant memories. This, however, is to be firmly overcome, until finally, when the repressed idea is at last unburied and held up before the patient, the hysterical symptom becomes violently aggravated—the final effort of

defence. He is thereupon compelled to do what he should have done in the first instance, namely, face the matter frankly, regard it sensibly, criticize it from all standpoints—and put it out of his mind.

The Weir Mitchell Treatment.

While on the subject of nervous diseases, it will be convenient to conclude with some account of the Weir Mitchell treatment of "nerve" cases—*i.e.*, of functional or neurotic, as opposed to organic, nervous disease. This seems the more desirable, inasmuch as every trained nurse in private practice is liable to find herself in charge of one of these cases, and yet, so far as her hospital training is concerned, her personal acquaintance with the treatment is probably nil. On the other hand, to a doctor treating a Weir Mitchell case, it makes all the difference whether his nurse is familiar with the treatment; indeed, there is no class of case in which the experience and character of the nurse count for more.

The treatment, first introduced nearly forty years ago by Dr. Weir Mitchell, the American physician, is specially intended for those neurotic cases whose maladies, psychical in essence, are largely aggravated by the moral and emotional influences of the patient's ordinary domestic environment. The first requisite of the treatment is, therefore, complete isolation of the patient from all relatives and friends; and this, in practice, means a nursing home of some sort. Next, after this mental rest, the treatment includes a complete physical rest, the patient being confined to bed and her wants supplied by the nurse. Third, in order to build up her physical and nervous energy, the patient is placed on a diet which, at first only milk, is added to every day until, at the end of ten days or so, very large quantities of wholesome food are being given at frequent intervals.

In favourable cases the treatment lasts as a rule for from six to twelve weeks, during which time the patient rapidly puts on weight, and her general physical condition greatly improves. At the same time her mental symptoms improve, and she becomes more or less a normal individual once again. After leaving the nursing home and before returning to her family, it is often wise for the patient to go away with her nurse for a fairly long holiday in order that she may gradually and safely pick up the threads of social life again.

The treatment almost always results in some improvement in the patient's condition, but a complete cure is not always possible, and in some cases a relapse follows later when the patient returns to the same old environment which was her undoing in the first instance. It may not be possible in every case to arrange that the patient should take up new interests and cultivate a new mental outlook on the world, but unless this is done, to some extent at any rate, a recurrence is not at all unlikely.

A great practical drawback to the treatment, and one that limits it to the well-to-do, is its expense. Apart from the cost of a fairly long medical attendance, the nursing home charges can hardly be small, not only because the cost of the patient's dietary is no inconsiderable item, but also because the exclusive services of a trained nurse, who is also skilled in massage, are needed.

CHAPTER XVII

DISEASES OF THE RESPIRATORY ORGANS

BEGINNING with the fact that the function of the lungs is to aërate the blood, supplying it with oxygen and relieving it of carbon dioxide, we find that a special arrangement of the circulation ensures that every ounce of blood, after each journey round the body, is sent through the lungs to be aërated before starting off again. Or, stated more particularly, the impure blood brought back along the veins is pumped from the right ventricle into the pulmonary artery, along which it passes to the lungs, returning laden with oxygen viâ the pulmonary vein to the left ventricle, whence it is despatched along the aorta to every organ of the body.

Now the lungs themselves are honeycombed through and through with myriads of little air cavities, called "alveoli," which are separated from each other by delicate partitions, over which is trailed a meshwork of blood-capillaries. The pulmonary blood, therefore, is admirably placed for absorbing oxygen from the air within the alveoli and for giving off in exchange its superfluous carbon dioxide. The vitiated air then passes out of the alveoli and along the smaller bronchi into the larger, whence it ascends the trachea to the larynx—here passing through the narrow slit between the two vocal cords—and is exhaled to the outside air. Fresh air in its turn is inhaled through the nose and mouth, flows down the air passages to the alveoli, and aërates more blood.

With this constant stream of air in and out, the danger arises, of course, that particles of dust, harmful organisms, etc., drawn into the lungs may be absorbed by the lymphatics and so pass into the circulation. As a matter of fact, however, these lymphatics lead direct to a series of lymphatic glands (the bronchial and mediastinal glands) which are able to arrest the further progress of any foreign bodies; and so efficiently is this done that these glands in town-dwellers are usually as black as coal from the soot inhaled with the smoke-laden atmosphere.

Next we must look at a rather more difficult question—namely, the mechanism which controls this flow of air in and out. The interior of the chest is divided vertically into two halves (the right and left pleural cavities), with the heart in between, and each half is lined by a smooth pleural membrane. Each cavity is filled by one lung, itself coated in a similar membrane. The space on each side between the membrane lining the cavity and that covering the lung is, however, a vacuum. The lung, therefore, which is very elastic, expands until it is everywhere touching the sides of the chest, bringing the two layers of pleural membrane in contact and thus obliterating the cavity. This sucker-like adhesion between lungs and chest is, perhaps, best compared to that seen in any draper's window between the plate glass of the window and the rubber discs used for suspending light articles. And just as, if air gets between the rubber and the glass, the disc falls away, so with the pleural vacuum, if air should happen to be let in (say, by a stab between the ribs), the elastic lung shrinks away from the chest, leaving a space filled with air between the two layers of membrane (pneumothorax). This important matter I shall have to refer to later (p. 137).

From the foregoing it will be obvious that since in normal circumstances lung and chest wall must keep in contact, any upward movement of the chest—heaving a

sigh, for instance—will draw the lungs with it, expanding them still more. This means that the alveoli are stretched open, and, consequently, that air flows in from without to fill them to their new capacity. In other words, a breath is taken. *Per contra*, a movement of the chest in the opposite direction enables the lungs to contract, thus driving air out of the alveoli—that is, exhalation occurs.

Respiratory Infections.

Turning now to the pathological side of the picture, we can readily understand that the respiratory organs are peculiarly exposed to infections by organisms in the current of air sweeping up and down to the lungs. While these infections are due to a variety of organisms, it is customary to speak of the resulting inflammations rather according to their anatomical positions than their bacterial causes. Thus an infection of the membrane of the nose is **Coryza**, even though it may be due to one of several organisms. Similarly, there are acute laryngitis, acute tracheitis, and acute bronchitis, while inflammation in the alveoli themselves is called pneumonia. Very often, however, an infection beginning at the upper end of the respiratory passages spreads within a few hours or days down towards the alveoli. Thus many cases of influenza begin as acute coryza—*i.e.*, a "cold in the head"—which is followed by acute laryngitis, this by acute tracheitis, then acute bronchitis, and, finally, by pneumonia. The same spread is seen in measles and diphtheria.

Again, the nasal cavities communicate by little ducts with several cavities, called "sinuses," in the bones of the skull—*e.g.*, the frontal sinus in the forehead and the antrum in the cheekbone—and inflammation may spread up these ducts, causing **Sinus Suppuration**.

On the other hand, some infections spare the upper

passages altogether and attack in the first instance only the lungs. This is seen in most cases of pneumonia and phthisis. Here again, however, the infection tends to spread. If it reaches the surface of the lung, it will inflame the pleural membranes, setting up **Pleurisy**; this may lead to the secretion of fluid into the pleural cavity (**Pleuritic Effusion**), which, if purulent, is termed an **Empyema.** Sometimes, again, a pulmonary infection spreads upwards along the respiratory passages, as in phthisis, when the constant expectoration of infected sputum inoculates the larynx, producing tuberculous ulcers. Another form of pulmonary infection sparing the upper passages is seen when any foreign body has been accidentally inhaled into the lung—particles of food, for example—by a half-conscious patient, or by a patient unable to swallow properly on account of bulbar paralysis. The infection in these cases is usually septic.

Finally, the infective organisms may pass by the lymphatics to the bronchial glands. Thus, in practically every case of pneumonia these glands are swollen and inflamed, while, more important still, tubercle bacilli absorbed along this route may be the cause of tuberculous bronchial glands.

The principal respiratory infections are as follows:

Hay-Fever, which usually takes the form of a cold in the head or an asthmatic attack, is provoked by the pollen grains of grasses, etc., irritating the nasal mucous membrane. It is most prevalent, therefore, in the early summer, when grasses are in flower. Nevertheless, pollen alone is not the whole story, for in many cases the nasal membrane is found to be already diseased, and when this is put right, the patient ceases to be susceptible to pollen. Yet a third factor is the neurotic temperament of the patients—a fact well illustrated by the case of a lady who was seized with an attack of hay-fever on smelling a flower which, though she did not know it, was artificial.

In **Acute Laryngitis** the lining membrane of the larynx is inflamed, causing a soreness of the throat, a dry cough, and, since the vocal cords are affected, husky speech or even complete loss of voice. In children the condition is known as *croup*. A chronic variety may develop in those who use their voices a good deal at their work—public speakers, clergymen, costermongers, etc. A spasmodic form of laryngitis, known as *laryngismus stridulus*, occurs in infants; it begins without warning, and the child rapidly becomes half suffocated and cyanosed until, in a few moments, the spasm relaxes and it takes a long-drawn breath accompanied by a peculiar crowing noise.

Acute Bronchitis, which, as we have seen, is often a downward spread of coryza, produces a feeling of tightness and rawness behind the breast-bone, cough, mucous expectoration, and perhaps distressed breathing. The temperature may be raised (100° to 101° F.). As the secretion loosens and the expectoration becomes easier, the symptoms subside. In severer cases, when the smaller bronchi are obstructed by mucus, the symptoms are graver — much respiratory distress, cyanosis, and perhaps failure of the heart.

Chronic Bronchitis, more especially a disease of old people, may follow an acute attack, but often begins insidiously, especially in the winter months. The patient, becoming troubled with cough and expectoration, is wheezy and short of breath, but otherwise may feel fit enough. After a time, however, the bronchial tubes, softened by the chronic inflammation and strained by the coughing, are likely to yield, forming dilatations—a condition known as *bronchiectasis*. In these dilated cavities mucus may collect, even in considerable quantity, and decompose, fouling the breath and occasioning an irregular temperature by the absorption of septic material from the lungs.

Pneumonia is an infective inflammation of the lungs, commonly due to the pneumococcus, in which the alveoli

become filled with inflammatory material, the affected part of the lung being thus converted from air-containing to solid tissue. The symptoms begin suddenly with a rigor and a rapid rise of temperature to 104° F. or thereabouts. The patient begins to breathe quickly, complains of pain in the side—the result of the pleura becoming infected—and has a frequent cough by which he expectorates a quantity of rusty-coloured sputum (*i.e.*, mucus stained with blood from the site of the inflammation). He remains in this state for a week, more or less, when the attack ends as suddenly as it began. This course represents a straightforward case, but the disease has several complications. Perhaps the worst is heart failure, which is responsible for many fatalities. Other complications are pericarditis, endocarditis, meningitis, and peritonitis, while even after the temperature has fallen to normal an empyema may develop.

In **Broncho-Pneumonia,** which occurs more frequently in children than adults, instead of one large part of the lung becoming consolidated, numbers of little areas are solidified. The distinction between the two at the bedside is often difficult, but fortunately is not always material. The course of broncho-pneumonia, however, though sometimes ending within a week, often runs for a month or more, the symptoms being fever, cough, and dyspnœa. Perhaps the most frequent complication is empyema. A septic form of broncho-pneumonia occurs, as has been previously mentioned, in patients who have inhaled particles of food into the lungs. It may also be caused by carelessly withdrawing the stomach-tube after nasal feeling, when some of the milk may drip into the larynx.

Pulmonary Tuberculosis or *Phthisis.* — The facts already given when discussing tuberculosis (see p. 86) may be supplemented by the following. Pulmonary tubercle develops by three stages, each, however, merging into the next. In the first stage the miliary tubercles are

forming in the lung tissue. Next, these tubercles, irritating the lung around, cause the neighbouring alveoli to become filled with inflammatory material—the stage of *consolidation.* In the third stage the centre of each solid patch softens and caseates, and, being coughed up, leaves a cavity marking its place in the lung; this is the stage of *cavitation.* The infection usually begins near the top, or apex, of the lung, and spreads gradually downwards.

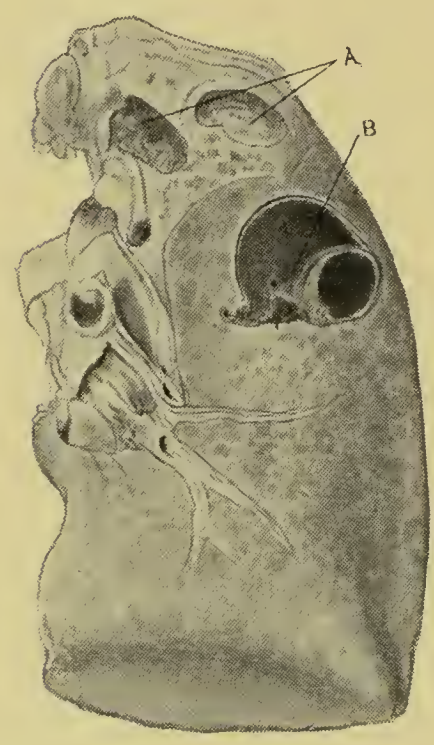

FIG. 11.—A TUBERCULOUS LUNG. Showing the changes of chronic tuberculosis at the apex, with two cavities (*A*), and, lower down, a larger cavity (*B*) filled with blood-clot. From a patient who died of hæmorrhage from the lung.

The *symptoms* of phthisis are pain in the chest, cough, expectoration (the sputum containing tubercle bacilli), and an irregular fever which is highest in the evenings. The patient loses weight, sweats at night, gets short of breath, and tires over-readily at his work. Sooner or later hæmoptysis is likely to occur from a bloodvessel eroded by the caseating process. In advanced cases anæmia, diarrhœa, and even lardaceous disease may become prominent features, while, of course, general tuberculosis may occur at any time. Though the complications include practically every other form of local tuberculosis, the more contiguous results are pleurisy, with or without effusion, empyema and—if a cavity in the lung bursts into the pleura—pneumothorax.

Circulatory Affections.

Compared with infections conveyed by inhaled air, the risks of infection by the blood are relatively small. True, syphilis, carried by the blood-stream, may establish itself in the respiratory tract, causing gummata or ulcers, but these are relatively uncommon. The only circulatory affections that need be considered are pulmonary embolism and hypostatic pneumonia.

Pulmonary Embolism.—The embolus usually comes from a clot in a vein (for example, the uterine vein after confinement) or from a vegetation in the right side of the heart, and, passing along the pulmonary artery, plugs one of its branches. Should the embolus be septic, it may cause suppuration, and this, when near the pleura, may lead to an empyema. Even without either of these complications an embolus may "infarct" a portion of lung with serious and often fatal effect. Indeed, pulmonary embolism is a cause of sudden death after surgical operations, which, of course, cause thrombosis in the vessels near the wound. The fact that the embolism is sudden, unforeseen, and unpreventable makes it all the more to be dreaded.

Yet another circulatory affection is **Hypostatic Pneumonia.** Without being either an infection or even a true inflammatory pneumonia, it is a congestion of the lowest parts of the lung, which is especially frequent in old, feeble patients confined over-long on their backs in bed. It may be fatal, but its prevention, which is to some extent a matter of nursing, is best assured by allowing aged patients to leave their beds at the first opportunity, and until then by propping them up in bed as high as possible.

Respiratory Obstruction.

Anything that prevents the free entry of air into the lungs is likely to cause a greater or less degree of suffo-

cation. The most serious cases are, of course, fatal within a few minutes, but even the milder obstructions not only make the patient's breathing difficult, but are likely to throw a strain on the heart. The causes of obstruction are pretty numerous, as might be opined from the considerable length of the air passages from the mouth to the lungs. In some cases a tumour, such as an aneurism or an enlarged bronchial or mediastinal gland, presses on the passage from without and narrows it. In the neck a goitre will often produce this effect, while higher up still an abscess at the back of the throat (**Post-Pharyngeal Abscess**) may obstruct the larynx.

In most cases, however, the obstruction lies within the passages themselves. Perhaps the most frequent cause is that commonly known as **Tonsils and Adenoids**, which, obstructing the throat and nose, are responsible for many ill-effects. Another cause is an infective inflammation of the lining mucous membrane of the passages, the latter becoming so swollen as partially or completely to block the airway—an effect seen at its worst, perhaps, in **Laryngeal Diphtheria**, but also in acute bronchitis. Another cause is œdema of the larynx, which may, indeed, suffocate the patient before tracheotomy can be performed. This **Œdema of the Glottis** is usually a part of the general œdema of Bright's disease, and is, in fact, one of the fatal complications of that disease. Yet, again, any growth beginning in the air passages, such as **Cancer** of the larynx, is bound to exert an obstructive effect; and the same applies to a **Foreign Body**, such as a piece of meat swallowed "the wrong way," a tooth that slips from the dentist's forceps, or a plug of wool carelessly used in swabbing the throat.

The narrowest part of the passages is in the larynx, at the level where the vocal cords project from either side; and since they can be made to meet, thus closing the

larynx, or be drawn apart, leaving a free airway, they may, if paralyzed, produce different varieties of **Laryngeal Paralysis.** When they cannot be drawn apart, serious obstruction may be the result, leading, perhaps, to suffocation, unless the danger is averted by tracheotomy. This *abductor paralysis* is generally due to pressure on the nerves to the vocal cords by a tumour in the chest, particularly an aneurism. In other cases the cords cannot be made to meet —*adductor paralysis*—a condition which, without causing any obstruction, leads to a complete loss of voice. This variety is hysterical, occurring especially in young women, and is sudden both in coming and going. The third variety is complete paralysis—adductor *and* abductor—when the cords can be made neither to meet nor to separate properly, but rest slack and motionless halfway. Sometimes only one cord is thus affected. The cause lies either in the nerve coming up from the chest or in the nerve centre in the bulb —as, for example, in bulbar paralysis.

An obstruction of another sort is **Asthma**, which is commonly regarded as a spasmodic contraction of the smaller bronchi. Ætiologically the disease may occur at any age, but especially in children, and is often seen in neurotic subjects and those with adenoid or other nasal affections. The attacks are provoked by a variety of circumstances—changes of climate, temperature, or locality; diet; the sight or smell of animals; fright, worry, etc. In a typical case the patient, quietly asleep at night, wakens in the early hours with a feeling of suffocation. His expirations are long-drawn and wheezy, but his greatest difficulty is in drawing air into his lungs; indeed, to help himself he will clutch the rail at the bottom of his bed, or the back of a chair, trying to use his arms to lever up his ribs. His face, pallid or cyanosed, and often bathed in sweat, betrays his anxiety. After the struggle has lasted for two or three hours the symptoms subside, mucus is expec-

torated, and the patient falls asleep exhausted. Apart from its immediate distress, asthma is serious on account of its tendency to produce emphysema—a condition which may therefore be considered next, although not in any way a form of respiratory obstruction.

Emphysema.—In this disease extensive changes are produced in the structure of the lungs. The little partitions between the alveoli become absorbed, until everywhere several adjacent alveoli are thrown into one large cavity, some as big as grapes. But this destruction of the partitions leads to two important results. In the first place the meshwork of capillaries is absorbed along with the partitions supporting them. This means that with, say, only one-half the number of capillaries left to convey blood, the heart must pump twice as vigorously to force all the blood through the half that remains. In other words, emphysema throws, sooner or later, a strain on the heart, and ultimately compensation fails. The patient with emphysema now becomes a typical "heart case." The other effect of the destruction of the partitions and capillaries is that the aëration of the blood becomes defective, and in some cases the patient may be as strikingly cyanosed as a child with congenital heart disease.

Pleural Affections.

It has already been explained how the lung clings, sucker-like, to the inside of the chest wall. As soon, however, as a **Pleural Effusion** begins to collect, the elastic lung draws away, leaving a space between the two layers of pleural membrane, which becomes filled with the exuded fluid. If the effusion is copious, the lung may contract to perhaps a quarter its proper size, the space representing the other three-quarters being filled with the fluid. Most of the air in the alveoli is therefore squeezed out, and the

lung, no longer expanding with the movements of the chest, is, in effect, out of action, and the patient, dependent on one lung only, is much distressed in his breathing.

Now, suppose that in such a case it is decided to tap the chest, and a canula is inserted. What happens? No fluid escapes. Any fluid removed from the chest would necessitate the lung expanding to a corresponding extent to fill the space of the fluid withdrawn. But the elastic contraction of the lung prevents this expansion, and therefore the fluid is held in its place and nothing flows from the canula. In fact, it is only by forcibly sucking out or "aspirating" the fluid, and so compelling the lung to expand, that a pleuritic effusion can be withdrawn. (The reader will be familiar with the apparatus—canula and tube leading to a bottle from which the air has been exhausted by an aspirating pump.)

Precisely the same state of affairs is produced if, instead of fluid, air gets into the pleural cavity—a condition called **Pneumothorax**. The lung shrinks up to a small size, leaving the space between it and the chest wall filled with air; and so rapidly may it contract that the patient may experience the greatest difficulty in breathing, becoming cyanosed, and perhaps dying in a very short time. Pneumothorax, though sometimes caused by a stab between the ribs, is more often the result of a rupture of the lung near its surface, the air escaping from the alveoli through the tear into the pleural cavity.

Mediastinal Tumours.

The mediastinum is, anatomically, the space in the middle of the chest between the two lungs. It is occupied mostly by the heart, but also by the lymphatic glands, previously mentioned, to which run the lymphatics from the lungs. These glands cluster round the "root" of each lung—*i.e.*,

that part of the lung where its bronchus and pulmonary artery enter, and its pulmonary vein emerges—and their function, as has been pointed out, is to intercept noxious material absorbed from the lung, thus protecting the rest of the body.

One result of this attitude of standing on guard is, as we have already seen, that the glands are liable to become black with dirt in town-dwellers, though in babies they are soft and pink. A more definitely pathological result, however, is seen in infective inflammations of the glands. It is probably correct to say that in every inflammatory affection of the lungs these glands are swollen. But when in this state, they are likely, owing to their position close to the root of the lung, to press against and obstruct the bronchus. Indeed, the suggestion has been made that in whooping-cough this is the explanation of the paroxysmal cough. When the glands are enlarged from tubercle, they are particularly liable to caseate, and in this condition they may obstruct the bronchus or even burst into it, the caseous pus being inhaled into the lung and setting up a very acute form of pulmonary tubercle. Yet again, these caseous glands are frequently the starting-point of tuberculous meningitis, though why this should be the case is still a puzzle. The largest mediastinal glands of all are those developing cancerous, especially sarcomatous, growths; in these cases they obstruct not only the bronchus, but veins as well, and even push the heart out of its place.

The effects of these tumours, as seen at the bedside, are mainly attributable to the pressure they exert on neighbouring structures. For example, on account of pressure on the bronchus the patient is short of breath, and often has a paroxysmal cough; from pressure on the nerves to the vocal cords he may develop laryngeal paralysis; while pressure on the veins (usually those from the upper parts of the body) is responsible for œdema of the arms and neck.

CHAPTER XVIII

DISEASES OF THE DIGESTIVE ORGANS

I. Diseases of the Mouth and Throat.

The mouth and throat, which offer so accessible and congenial a lodging for micro-organisms, are, perhaps, the site of a larger variety of infections than any other part of the body. No doubt for this reason the neighbourhood is particularly carefully guarded against the spread of infection by generalization.* To begin with, there are numbers of glands on either side of the neck straining off or rendering innocuous any harmful matter coming from the mouth. Still closer at hand, however—namely, at the back of the mouth—are two large lymphatic glands—the tonsils—ready to take arms against any intruding organisms; while near by, right at the back of the throat and nose, are others best known by the name, given them when they enlarge, of "adenoids."

Thanks, in part, at any rate, to this defensive arrangement, many cases of mouth infections show few, if any, but local symptoms; but from these simple examples every

* Before going further, the reader may be reminded that the lymphatics—minute vessels draining a neighbourhood of its lymph, *i.e.*, its superfluous fluid other than blood—lead to lymphatic glands, whose function is to hold back or strain off any organisms from the lymph which, now purified, flows away by other lymphatics from the opposite side of each gland, and finally enters the blood-stream.

grade of severity can be found. This is well exemplified by the various inflammations of the mouth, which go under the name of **Stomatitis**. The mildest variety is parasitic stomatitis, or *thrush*, in which a fungus grows over the tongue and cheeks, studding them with little white patches, but without causing any constitutional symptoms. In *ulcerative stomatitis*, ulcers, often very tender, develop both on the floor and roof of the mouth, and mild constitutional symptoms may result. Severest of all is gangrenous stomatitis, or *cancrum oris*, which, beginning on the inside of the mouth, spreads with alarming rapidity through to the face, the cheek very probably sloughing and producing a hideous deformity; the constitutional symptoms are very severe and frequently lead to death. All these forms of stomatitis are intimately related to uncleanliness of the mouth—a fact which suggests both the prevention and cure. Cancrum oris, in particular, which used to be seen in patients with typhoid or scarlet fever, has, in recent years, since nurses have given special attention to keep the mouth clean, become very rare.

To pass next to the affections of the teeth, the results vary from the comparatively unimportant to the serious and fatal. **Dental Caries**, which is really an ulceration of the teeth, and **Pyorrhœa**, a chronic septic infection of their sockets, are exceedingly common, and may seem to entail nothing but local trouble. Nevertheless, in many cases they lead to medical complications of the first importance. Thus in each of these conditions pus is incessantly flowing into the mouth, mixing with the food and being swallowed to the stomach, with the result that these dental conditions stand foremost among the causes of chronic dyspepsia. Worse still, the septic material may be absorbed into the system, producing grave and even fatal results, such as chronic rheumatism and severe anæmia. Apart from risks in this direction, a decayed tooth may be the point of entry

of tubercle bacilli, leading, especially in children, to tuberculous glands of the neck, and thence, perhaps, to fatal general tuberculosis.

Yet a third important group of mouth infections is that comprising the various forms of **Tonsillitis**. Of these the ordinary sore throat, or *follicular tonsillitis*, may be considered first. Both tonsils are usually affected, becoming swollen, red, and covered with little white specks, which are really collections of secretion plugging the little crevices (follicles) on the surface of the tonsil. A fair amount of septic material is absorbed along the lymphatics, causing marked swelling of the glands of the neck. The patient, who soon finds swallowing painful, becomes feverish (101° to 104° F.) and feels ill, but within a few days recovery begins. *Rheumatic tonsillitis*, which is associated with acute rheumatic fever, is never severe, often, indeed, passing almost unnoticed and causing little swelling of the glands. It develops early in the case, and the tonsils, on examination, are found to be only slightly swollen. Both this and the previous form are very apt to recur, leading ultimately to chronic enlargement of the tonsils, which may then partially block the throat, impeding the breathing and affecting the tone of the voice.

Sometimes, however, a case beginning with the symptoms of follicular tonsillitis develops severer local and constitutional symptoms, and one or both tonsils are found to be ulcerated—*ulcerative tonsillitis*. Or again, one or both may become very swollen indeed, perhaps meeting across the throat, the pain becomes throbbing, and an abscess forms inside the tonsil—*quinsy*. In *scarlatinal tonsillitis* the whole throat is likely to be inflamed, tonsils, palate, and uvula, with much swelling of the glands. The nature of the attack becomes evident when the rash develops within twelve to forty-eight hours. *Diphtheritic tonsillitis* differs from the other varieties in that the local inflammation set up by the

diphtheria bacilli is severe enough to kill the surface-layer of the tonsils, converting it into the characteristic greyish-white "membrane"; and, as the infection extends, so the surface of the palate, etc., is likewise killed and the membrane spreads accordingly.

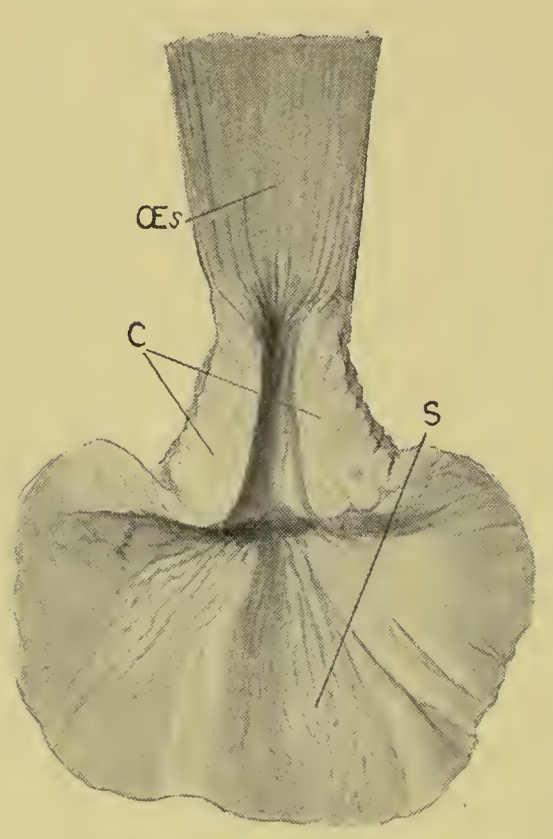

FIG. 12.—CANCER OF THE ŒSOPHAGUS. Showing the lower end of the œsophagus (*Œs*) and a part of the stomach (*S*). A mass of cancer (*C*) narrows and obstructs the passage.

II. Diseases of the Œsophagus.

The œsophagus, with its relatively simple duty of conducting food from the mouth to the stomach, is subject to no great variety of pathological changes; but the few that occur are important in that they obstruct the passage of food, producing difficulty in swallowing (*dysphagia*), and, likely enough, semi-starvation. The causes of this obstruction are various. In some cases the œsophagus is pressed upon in the chest by an aneurism or a mediastinal tumour; in others, after an œsophageal ulcer, caused perhaps by swallowing some strong acid, has healed, the scar contracts, gradually narrowing the passage. The commonest cause, however, is **Cancer** of the œsophagus itself—an inevitably fatal condition, since its surgical

removal is out of the question on account of the inaccessible position of the growth in the chest; at best, the patient's life may be prolonged by feeding him through an opening (gastrostomy) direct into the stomach. Finally, some neurotic patients develop an **Hysterical Spasm** of the œsophagus, which, by causing dysphagia, may be suggestive of cancer. The distinction is established, however, by passing a rubber bougie, when, if the obstruction is merely a spasm, the bougie, gently pressed onward, will slip through readily enough; but with a malignant growth the case is otherwise. When the nature of any œsophageal condition is doubtful, the matter may best be cleared up by the use of Killian's electroscope, which is a metal tube with reflecting mirrors, by which the whole length of the œsophagus can be examined from the inside.

III. Diseases of the Stomach.

The stomach, which, it will be remembered, lies between the œsophagus at the one end and the intestines at the other, is a sac or bag large enough when moderately stretched to contain an average meal, and is closed at the far end by an elastic mouth, the pylorus, leading into the intestine. During the four or five hours it retains a meal it is incessantly contracting and relaxing, churning up the food, and thus thoroughly mixing it with its own secretion, the gastric juice. Towards the end of the time, when the food has been reduced to a thick, soupy liquid, the pylorus opens now and again, allowing this half-digested, acid fluid to run through into the duodenum. When finally emptied, the stomach contracts to a fairly small bag again, and, its work being done, rests quietly until the next meal. This orderly digestion proceeds so smoothly as to cause no discomfort; indeed, if any effect is noticed, it is probably a feeling of content and well-being. But let digestion be

deranged, and the picture is different—a picture which goes by the name of "dyspepsia."

Dyspepsia. — (1) Sometimes a patient, after rapidly filling his stomach with a quantity of indigestible material —cheese, ices, beer, etc.—soon feels uncomfortable at the stomach, notices a headache, and begins to feel sick. This is *acute dyspepsia*. Before long, perhaps, he vomits, and, the stomach well rid of its contents, the attack subsides. (2) In other cases the patient feels pain after every meal, particularly in the pit of the stomach and passing through to between the shoulders—a dull, gnawing, dragging pain, which makes him retch, and now and again to vomit. He loses his appetite, becomes depressed and irritable, and is troubled with constipation. Probably he suffers much from flatulence, and may find an acid fluid rising to the throat, while not at all infrequently his distress is accentuated by palpitation of the heart. These are the symptoms of *chronic dyspepsia*, of which several varieties are recognized. Thus Fermentative Dyspepsia—the condition in which food ferments or decomposes in the stomach—is a common result of decayed teeth or pyorrhœa: the fermentation produces irritating acids, and these, accumulating as digestion advances, set up pain, which becomes aggravated the longer it is since the last meal; after the next meal, however, the acids are neutralized for the time being, and the patient feels comfortable. Again, with Hyperchlorhydria (dyspepsia in which the stomach secretes an excess of hydrochloric acid) the pain gets steadily worse up to mealtime as the acid accumulates, but is quickly relieved by the next meal, which uses up the acids in the process of digestion. On the other hand, in Atonic Dyspepsia, when the muscular power of the stomach is at fault, and the food cannot be properly churned, the pain may be incessant, because the stomach never empties itself effectually, and probably becomes dilated. Finally, in Nervous Dyspepsia, the stomach

would act well enough if it were not for the irritability of its nerves—the responsibility for which, however, lies less often with the stomach itself than with the nervous organization of the patient—which make the mucous membrane very sensitive and painful (*gastralgia*), except to the blandest of foods.

In the *treatment* of dyspepsia, once the cause has been traced, the cure is generally easy. The teeth have already been referred to as one cause. Among others the commonest, perhaps, are tobacco-smoking in men, tea-drinking in women, and tippling in either sex. Next after these suspicion falls on the nature and quality of the food. Finally, the digestive power of the stomach would be ascertained by a "test meal." The patient, after a night's fast, is given either a slice of bread and half a pint of tea, or some meat and bread, which, after a suitable time for digestion, is withdrawn from the stomach by a tube, and chemically tested.

Gastric Ulcer.—Although the cause is not known of this important condition which so frequently affects both sexes, but particularly young women, some ascribe it to embolism of a small gastric artery with infarction of the mucous membrane, which, now unable to withstand the action of the gastric juice, becomes digested, leaving a raw, chronic ulcer. Whatever its beginnings, however, the ulcer is generally found towards the pylorus, where it tends to spread and to eat its way through the thin wall of the stomach. This involves risks of more than one kind. In the first place the ulcer may eat into a bloodvessel, which will bleed into the stomach, perhaps furiously, and the blood be vomited (*hæmatemesis*). Or it eats clean through the stomach into the peritoneal cavity (*perforation*), and the food that escapes sets up peritonitis. Or it may spread into the tissues behind the stomach, set up inflammation, and produce an abscess; in this event the abscess will probably lie immediately beneath the diaphragm (*subdia-*

phragmatic or *subphrenic abscess*, see p. 164). Still, none of these complications is inevitable, and sometimes the ulcer will heal; but even then one or two after-effects may show themselves in course of time. In one of these the scar of the ulcer contracts until it so narrows the pylorus as to obstruct the opening into the intestine (*pyloric obstruction*). When this happens, the stomach becomes chronically over-distended (*dilatation*), and can now be emptied only by

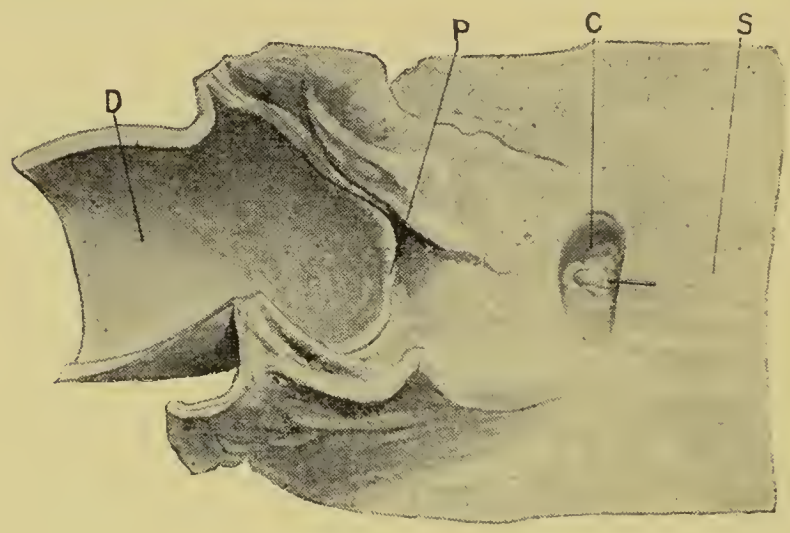

FIG. 13.—GASTRIC ULCER.

Showing part of the stomach (*S*) and of the duodenum (*D*) separated by the pylorus (*P*). At *C* is a chronic ulcer, and, exposed in its floor, an artery which has ruptured at the opening marked by the bristle. The patient died from the resulting hæmorrhage.

vomiting. This occurs every few days, pints of fluid, the stagnant accumulation of many meals, being cast up each time. Once this stage has been reached, the best remedy is to make an artificial opening from the stomach into the intestine (gastro-jejunostomy) through which the food can pass without traversing the pylorus. The second after-effect is *cancer*, which may develop in the scar of the ulcer This condition will be considered immediately.

The *symptoms* of an ulcer are such as might be expected

when a raw, sensitive surface is exposed to the irritation of food. That is to say, there is likely to be pain soon after meals, nausea, and perhaps vomiting, which, by removing the source of the irritation, is speedily followed by relief. Moreover, the patient often finds herself tender when pressed on over the site of the stomach. Frequently, however, it is only when hæmatemesis occurs that the diagnosis can be made with any certainty.

The *treatment* is either medical or surgical. In the former the aim is to allow the ulcer to heal by giving rest to the stomach—in other words, by strictly dieting the patient. Surgically, the ulcer can be cut out altogether, the opening in the stomach being made good by sewing together the edges around.

Cancer of the Stomach, though sometimes occurring, as has just been seen, in the scar of an ulcer, often develops in patients with no history suggestive of old stomach trouble. In fact, unlike ulcer, it is commoner in men than women. Still, it is noteworthy that cancer most often begins near the pylorus. Here it grows into a thick, fleshy mass, projecting into the stomach, and, of course, obstructing the pyloric opening ; and as before with a healed ulcer, dilatation with its copious vomiting is the result. Furthermore, cancer itself may ulcerate, causing hæmatemesis, peritonitis, or a subdiaphragmatic abscess ; it may even open into the colon, thus allowing the meals to run out of the stomach direct into the large bowel, whence they are evacuated practically unchanged.

Its early *symptoms* are not dissimilar to those of dyspepsia, or even gastric ulcer ; but later a tumour can be felt in the abdomen. Even before this the patient becomes very anæmic and steadily loses weight. In dubious cases the electroscope may be as useful here as in the œsophagus.

A last condition requiring mention is **Congenital Pyloric Stenosis.** This is a form of pyloric obstruction occurring

in new-born babies, and is due to a malformation of the pyloric end of the stomach. Naturally, the condition is very serious, inasmuch as the child, with its stomach unable to give passage to the feeds into the intestines, vomits persistently and rapidly wastes. Operation has been resorted to, but the risk is great in patients so young and enfeebled. On the other hand, medical treatment, which consists of gastric lavage, is often unsuccessful.

CHAPTER XIX

DISEASES OF THE DIGESTIVE ORGANS

(Continued)

IV. Diseases of the Intestines.

The intestines complete the digestion begun by the stomach and absorb into the circulation from the liquid food all such nourishment as the body requires. To effect this they move in a wormlike fashion (peristalsis), driving the food slowly onward, digesting and absorbing all the time. Finally, only the indigestible residue is left, which, now more or less solid on account of the water having been absorbed, collects as fæces at the lower end of the bowel, whence once a day or so it is voided to the exterior.

Suppose, however, that this leisurely peristalsis is unduly stimulated, the contractions may be so vigorous as to cause griping, while the food, hurried along without time to be absorbed, arrives liquid at the rectum, where it is promptly expelled by the vigorous colicky contraction. In any case of **Diarrhœa**, therefore, the question arises, What is the cause of this rapid peristalsis? The choice lies between many. Nervousness, for one; a sudden change in the weather, with a fall in the temperature, is another. But the chief place must be given to irritating food—over-ripe fruit, tainted fish, contaminated milk, and so on. In these cases the diarrhœa is by way of being a curative effort by Nature to get rid of the irritant as soon as possible. But very often

inflammation follows—enteritis, if in the small intestine, colitis in the big, entero-colitis if in both, and gastro-enteritis if the irritant inflamed the stomach in passing through. In other cases the stimulus is a toxin in the blood: thus diarrhœa is common in septic conditions and in pneumonia at the crisis. Finally, the trouble may lie in the intestines themselves—tuberculous ulceration, for example.

On the other hand, peristalsis may become so enfeebled or obstructed that the food is either delayed in reaching the rectum, or, having got thus far, lies there for days before it is expelled (**Constipation**).

With this brief introduction we can now consider the principal intestinal affections.

Duodenal Ulcer.—This is an ulcer very similar to the gastric ulcer, except that it lies in the intestine, immediately beyond the pylorus. Its pathological consequences, symptoms, and treatment are not very unlike those of a gastric ulcer.

Enteritis is specially common in infants, where its most deadly variety occurs in epidemic form—*epidemic enteritis* or summer diarrhœa—in the late summer months. It is to be regarded as an infection, at present not identified, which lurks in cow's milk, to which it is conveyed by house-flies or by dust. Nevertheless, its occurrence in breast-fed babies shows that domestic hygiene plays its part. The *symptoms* of enteritis are griping pains with gurgling noises as the liquid food is hurried along the intestines, and diarrhœa; in addition, fever, headache, and sickness may be present. The *treatment* in the earliest stage is to administer a purge which, by stimulating the intestines, will hasten the passage of the irritant. At any later stage, however, when the irritant has probably already been evacuated and the patient is suffering from its after-effects, a purge would only aggravate the case; instead, some sedative, probably opium, is necessary. In the epidemic form the child, rapidly

depleted of its bodily fluids by the diarrhœa, becomes shrunken, wasted, and exhausted; sometimes it lies half unconscious, uttering feeble moans. For treatment it may be advisable, in the beginning, to wash out the stomach and bowel, while later, when the prostration begins, subcutaneous infusions will probably be required.

Colitis.—Apart from entero-colitis, two special forms of colitis require mention. In *ulcerative colitis* the mucous membrane, very acutely inflamed, sloughs and ulcerates until almost the whole length of the colon is denuded of its lining. The symptoms include colicky pains with frequent diarrhœa, the motions being very offensive and containing blood and shreds of slough; and an irregular fever caused by septic absorption from the ulcers. The patient becomes much wasted, and probably dies. Sometimes the ulceration will spread through the coats of the bowel to the peritoneum, setting up a rapidly fatal peritonitis, while occasionally a more distant infection may occur, such as infective endocarditis or suppurative pylephlebitis (see p. 158). A special infective form of ulcerative colitis occurs in the tropics, and is known as *dysentery*. The symptoms are very similar to those just given, but often abate after a week or so, and the patient may recover; in other cases the dysentery becomes chronic, lasting for months or years.

The second variety of colitis is *mucous colitis*, in which, after a severe paroxysm of griping pain, a quantity of mucus is passed, often in thick pieces, sometimes, indeed, so large as to be practically a cast of the inside of the bowel. The attacks recur at intervals of days or weeks, and between them the patient may be much constipated. The complaint is more frequent in women than men, and the patients are almost invariably highly nervous subjects.

Appendicitis.—The appendix, a narrow process of intestine, opening at one end into the large bowel, and blind at the other, is peculiarly liable to be suddenly and acutely

inflamed, the symptoms being severe abdominal pain and tenderness, fever, constipation, and perhaps vomiting. In milder cases these subside within a few days, but may recur at any time; in the severer cases the inflammation spreads through to the peritoneum, setting up *peritonitis*, either limited to the immediate neighbourhood or generalized over the whole abdomen. The former, local peritonitis, may end in the formation of an *abscess*, and this may burrow in one of several directions, but most frequently downwards into the pelvis, where, if not opened, it may burst into the rectum or vagina. Another complication is for the septic material to gravitate into the hollow of the back beneath the diaphragm, there to give rise to a *subdiaphragmatic abscess*. Finally, appendicitis, even in a mild form, may occasion *suppurative pylephlebitis*.

Intestinal Obstruction is produced when the passage along the bowel is stopped at any point. Thus a cancer growing in the gut, and encircling it like a ring, projects into the passage, and ultimately blocks it. Or the scar of a healed intestinal ulcer may lead to the same result; or the intestine may be nipped from the outside by a tumour or by a "band"—*i.e.*, a string-like process which sometimes forms in the abdomen. Two special forms of obstruction need a word of explanation—intussusception and volvulus. In *intussusception*, which is most frequent in children, a length of intestine is drawn into the next length lower down—just as if, in taking off a glove, the end of one finger should get drawn into the rest of the finger. When this accident happens in the intestine, the ingoing length becomes so congested and swollen as to obstruct the passage altogether. Not only this, but more and more of this length is likely to become drawn in by the action of peristalsis, until finally it extends the whole length of the lower bowel, and may finally hang out at the anus. *Volvulus* is a twisted gut. The condition will perhaps be best under-

stood by taking a piece of rubber tubing to represent the intestine, and making a few inches of it into a loop, holding the two ends of the loop between the thumb and forefinger; if now the loop is twisted right round, the two ends will become entwined and more or less tied into a knot—a result which, in the intestine, is called "volvulus."

The effect of intestinal obstruction, however caused, is stoppage of the bowels; what has already passed beyond the obstruction may reach the rectum and be evacuated, but after this complete constipation follows, not even flatus escaping. (An exception to this must be noted in cases of intussusception, where frequent motions of blood and mucus are the rule.) Higher up, on the stomach side of the obstruction, however, the food ferments and decomposes until so much gas is generated that the intestines become blown up, and the more they are distended the bigger and tighter becomes the abdomen, and, of course, the worse the pain. Sickness soon begins, and before long foul-smelling, fæcal-like material is vomited. The seriousness of the condition is now reflected in the patient's general condition. His face is drawn and his eyes sunken and dark-rimmed; the pulse grows quick and feeble, the tongue is dry, the thirst increasing, and the temperature falls below normal. These symptoms of collapse become steadily worse, and if the obstruction is not relieved by operation the patient dies, probably in about four or five days. The diagnosis, therefore, must be made at the earliest moment, the abdomen opened, and the obstruction relieved. This may mean cutting out a length of intestine containing the cancer or scarred ulcer, and stitching the severed ends together; or a band must be snipped across, or a volvulus untwisted, or an intussusception straightened out, or, if this is not possible, cut out, and the ends sewn together as before.

V. Intestinal Worms.

The four common varieties are the tapeworm, the hydatid worm, the round-worm, and the thread-worm.

The **Tapeworm** (*Tænia solium*), which inhabits the small intestine, is a white, flat, tape-like worm often several yards long. Its whole length is divided regularly into segments, each of which, when mature, produces a quantity of eggs which escape in the fæces. Some of these eggs may get scattered by the wind or cling to grass, and a few perhaps will ultimately be swallowed by cattle or pigs. Once in the animal's stomach the egg-shells are dissolved, the embryos escape, and, boring their way into the bloodvessels, are circulated to all parts of the body, where they surround themselves in little bladders ("bladder-worm"). If now the partly cooked flesh of these animals is eaten by a human being, the worm emerges from its bladder, and attaching itself firmly by its head to its host's intestines, grows into a tapeworm, which in due course produces eggs, which pass out in the fæces—and once again the cycle begins. To get rid of a tapeworm, nothing avails short of dislodging its head, but as this is only the size of a pin's head, it must be very carefully sought by washing the fæces through fine muslin and scrutinizing the residue. For a couple of days beforehand the patient is lightly dieted and gently purged. On the appointed night a dose of male-fern extract, which is fatal to the worm, is given on an empty stomach, and the next morning, the patient still fasting, a brisk purge sweeps out what little remains in the bowel—tapeworm and all. The motion is then searched for the head.

Another tapeworm, **Hydatid** (*Tænia echinococcus*), which measures only a quarter of an inch, attaches itself to the intestine, not of a human being, but of a dog, in whose excrement its eggs escape. These—perhaps blown about in the street dust—may be swallowed by a human being,

in which case they hatch in his stomach, bore their way into the bloodvessels, whence they are carried to the liver, brain, lungs, and elsewhere. Here they form the usual bladder, which is known as a "hydatid cyst," and which may come to contain several pints of fluid—with serious effects on the neighbouring parts. The treatment is to open, drain, and remove the cyst.

The **Round-Worm** (*Ascaris lumbricoides*) is in appearance not unlike a common garden-worm—round, tapering, pink, several inches long. It prefers the small intestine to live in, but has been found in the stomach, œsophagus, and even in the nose. Indeed, in exceptional cases a worm has wandered into the larynx—producing fatal suffocation—along the bile-duct to the liver, or up the Eustachian canal to the ear, where it appeared to the outside world. As to the symptoms, they are perhaps most usually recognized retrospectively after the worm has been passed *per rectum* or vomited. One other point. Sometimes a neurotic girl has been known to show to her relatives and doctor a worm which she has vomited—so she says—but which, on examination, proves to have been first captured in the garden. To distinguish the two varieties it may be useful to know that the round-worm lacks the bristles which the earthworm needs to help it along—a distinction easily made out by drawing the worm, tail first, between the finger and thumb, when the rough bristles, if present, will be readily felt. To dislodge an ascaris, morning doses of santonin combined with a purgative are given for three or four days.

Thread-Worms (*Oxyuris vermicularis*), white and small, rarely more than half an inch long, people the large bowel from the cæcum to the anus, where they are apt to produce a good deal of irritation, and whence they may make their way into the vagina. While purgatives may dislodge a good many worms at once, the most direct method of attack is by rectal injections of salt and water, quassia infusion, etc.

CHAPTER XX

DISEASES OF THE DIGESTIVE ORGANS

(*Concluded*)

VI. Diseases of the Liver.

To understand the part played by the liver in disease it is necessary to return for a moment to the question of the absorption of food from the intestines into the circulation. This takes place along two routes, the portal vessels and the lacteals, but with the latter we are not concerned for the present. The portal vessels are the veins carrying off the blood from the whole length of the alimentary canal—from the lower end of the œsophagus to the rectum. They convey, therefore, blood that is richly laden with nourishment, but, instead of flowing in the ordinary way into one of the main veins and so to the heart, they join to form one large *portal vein* which runs direct to the liver. Here, unlike any other vein in the body, the portal vein divides into branches, becoming at last a network of capillaries in the interior of the liver. By this arrangement the alimentary blood is carried in a gentle stream past all the microscopic cells in the liver for the purpose, of course, of allowing these cells to store up the nourishment until it is needed by the body. When this time comes, the nourishment is set afloat again in the portal capillaries, which, reuniting to form larger veins, ultimately pour the blood into the main vein to the heart, whence the nourishment is quickly distributed all round the body.

Now, the pathological bearings of this "portal system" are seen in connection with local affections of the alimentary canal. For instance, a cancer develops in the stomach, and as is usual, little fragments of it become detached as malig-

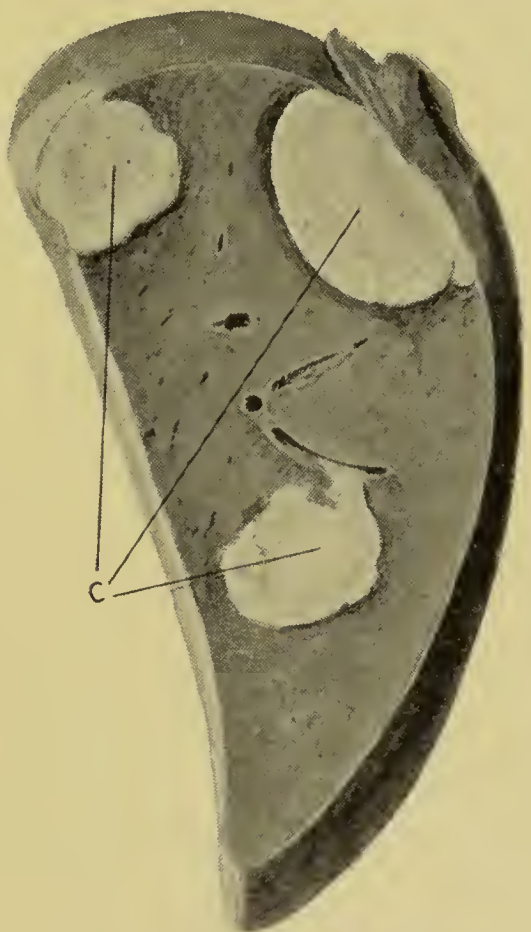

FIG. 14.—CANCER OF THE LIVER.
A slice of liver showing three deposits of cancer (*C*), secondary to a malignant growth in the stomach.

nant emboli. Where will they be carried? Obviously along the portal vein to the liver, where, arrested in the portal capillaries, they will develop into secondary growths. In this way is explained the frequency of **Cancer of the**

Liver, secondary to alimentary cancers anywhere from the stomach to the rectum. Or again, take a local infection in the alimentary canal—appendicitis or a gastric ulcer—septic particles may be carried along the portal vessels to the liver, where they become the starting-points of innumerable little abscesses—a condition previously mentioned and known as **Suppurative Pylephlebitis**.

This intimate relation between liver and alimentary canal may, however, operate the other way round—that is to say, if the liver is diseased the harmful effects may be spread over the whole alimentary canal or "portal area." Thus a very common affection of the liver is cirrhosis; the liver becomes permeated with fibrous tissue, which, being scar tissue, begins to contract, and therefore presses on and half obstructs the portal capillaries. The effect on the portal area is considerable, for the blood endeavouring to come to the liver along the portal vessels is dammed back, œdema is the result, and the œdematous fluid oozes from the intestines into the peritoneum, causing *ascites*.

But even if the blood can flow readily enough into the liver, it may yet meet with difficulty in its short passage thence to the heart, because, in cases of heart disease, if the tricuspid valve leaks, blood escapes through the valve into the veins, thus holding back the flow coming up from the liver. The result is to make the liver congested and swollen; and this in its turn reacts on the portal area, leading to ascites as before.

So much for the pathological aspects of the portal system. Now let us turn to another set of pathological risks connected with the liver. One of the functions of this organ is to excrete bile, which is formed from the red pigment of worn-out blood-corpuscles. Produced in the liver cells, the bile passes into a network of bile capillaries in the liver (quite separate from the portal capillaries), and these, uniting to form larger ducts, lead the bile out of the

liver to the main bile-duct, which, burrowing through the pancreas and receiving the pancreatic duct as a tributary, opens into the duodenum a little beyond the pylorus. Bile is one of the digestive juices, and as it is needed only as food is coming through from the stomach, much of it would be wasted if it trickled incessantly, food or no food, into the duodenum. A side channel, therefore, leads from the bile-duct to a special reservoir, the gall-bladder, where the bile collects until it is needed.

This biliary system, for all its simplicity, is not too simple to be deranged. Sometimes a little catarrhal inflammation spreads in from the duodenum, and, reaching the smaller ducts, swells their mucous membrane until the bile coming down from the liver cannot get past. It is, therefore, absorbed into the bloodvessels of the liver, and, carried into the circulation, soon tinges the patient's skin and eyes a golden yellow (**Catarrhal Jaundice**). Continuing round the circulation, it comes to the kidneys, where it is excreted in the urine, deeply staining it. And with no bile mixing with the food, the motions, deprived of their normal colouring matter, become clay-coloured.

This catarrhal jaundice is only a mild affair, the more serious biliary affections starting in the gall-bladder. For a reason yet to be found, the bile collecting in the gall-bladder is peculiarly liable to form calculi, or **Gall-Stones.** Perhaps no harm comes of this until a stone, attempting to pass along the narrow duct, stretches it severely, causing intense pain until the stone escapes into the duodenum (*biliary colic*). But often it will get held up just before reaching the duodenum, where the duct happens to narrow, and here it obstructs the passage of bile, and jaundice follows as before. An even more serious result of gall-stones is seen when the gall-bladder becomes acutely inflamed (**Cholecystitis**) and filled with pus. This septic infection is apt to spread along the bile-ducts to the bile

capillaries in the liver itself (**Ascending Cholangitis**), and numberless little abscesses develop—a result that recalls the multiple abscesses of suppurative pylephlebitis, though, of course, the cause is different in the two cases. Finally, gall-stones constantly irritating the gall-bladder

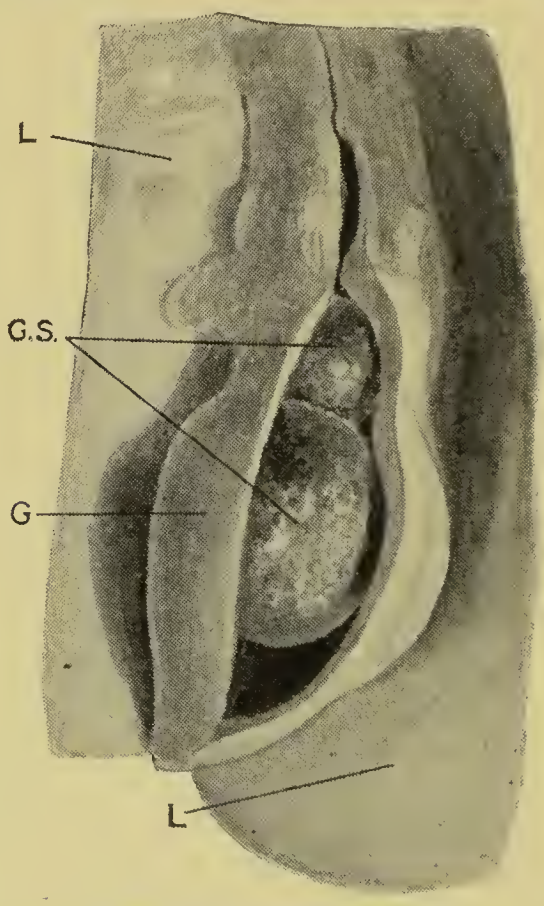

FIG. 15.—GALL-STONES.
A gall-bladder (*G*) laid open to show two large gall-stones (*G*, *S*). *L*, *L* is the adjacent part of the liver.

may be responsible for, or at any rate have a share in, producing **Cancer of the Gall-Bladder.**

It remains now to add a few details of certain hepatic diseases.

Cirrhosis, which we already know as a fibrous change in the liver, is more often caused by chronic alcoholism

than by anything else ; but it occurs from other less understood causes. It is even found in cats, though their temperance is unimpeachable. Not every patient, therefore, with cirrhosis is a drunkard, though most may be. In addition to developing ascites in the way already explained, the patient becomes slightly jaundiced, and suffers from nausea and occasional vomiting. A more striking symptom is the vomiting of blood (*hæmatemesis*), which may, indeed, be fatal. The blood comes from a vein at the lower end of the œsophagus, which ruptures after having become varicose to provide an alternative route, direct to the heart, for the portal blood impeded in its passage through the liver. Similarly, and for the same purpose, the veins at the other end of the alimentary canal — the rectal veins — become varicose ; the cirrhotic patient, therefore, suffers from piles, which may rupture and bleed.

Acute Yellow Atrophy, though a rare disease, deserves mention if only because of its almost uniformly fatal result. Its nature is imperfectly understood, but it would appear to be an infective condition spreading up from the duodenum, but so intense as to destroy the entire liver. It is commoner in women than men, and has a remarkable association with pregnancy. The symptoms, which for a day or two are those of catarrhal jaundice, later include fever, vomiting, and bleeding beneath the skin ; delirium and coma lead in quick succession to death.

Lardaceous (Amyloid) Disease.—In any patient the subject of prolonged suppuration—as from a tuberculous joint, or from tuberculous cavities in the lung with secondary septic infection, or from syphilitic ulceration—some curious changes in the appearance of the liver (and also of the spleen and kidneys) may be seen. The liver becomes much enlarged, and is studded with little semi-translucent, waxy-looking spots. Though presenting no symptoms

beyond this enlargement, the lardaceous liver carries a sinister importance, since it usually heralds the end.

Hydatid, Gumma, and **Primary Cancer of the Liver** call for no special mention.

VII. Diseases of the Pancreas.

The diseases of the pancreas fill at present only a small corner in the field of medical pathology, largely, no doubt, on account of their indefinite symptoms, which are especially likely to inculpate other organs rather than the pancreas itself. This is, perhaps, no more than might be expected, since the organ lies in contact with the peritoneum, and is likely to produce symptoms suggestive of peritonitis; and, secondly, since it is traversed by the main bile-duct on its way to the duodenum, and may therefore produce jaundice. Taking the several diseases in turn, we find that the pancreas is sometimes attacked by an intense infective inflammation —perhaps spreading up from the duodenum—which quickly destroys part of the organ and causes hæmorrhages into its substance. The symptoms of this **Acute Hæmorrhagic Pancreatitis,** however, are mainly those of general peritonitis. Death usually follows in two to four days.

In **Chronic Pancreatitis** the organ is overrun with fibrous tissue, which, like fibrous tissue everywhere, tends to shrink, with the striking result in this case that the main bile-duct lying in its midst becomes so compressed that the bile-flow is obstructed and the patient becomes deeply jaundiced. Indeed, this persistent jaundice may be the solitary symptom, though often dyspeptic symptoms accompany it.

Similarly in **Cancer of the Pancreas,** a condition commoner than is sometimes supposed, the growth obstructs the bile-duct with the same effect as before. In addition, however, cancer produces the customary wasting of malignant disease.

VIII. Diseases of the Peritoneum.

The peritoneum is the smooth membrane lining the interior of the abdomen and wrapping round the abdominal viscera, which are thus enabled to move against each other without friction. The membrane, however, is so thin as to give no great protection against infections spreading through from the inside of the stomach and intestines.

Acute Peritonitis is caused in most cases by disease of the stomach or intestines, which spreads through to the peritoneum. Thus gastric and duodenal ulcers, typhoid ulcers, appendicitis, and ulcerative colitis are some of the leading causes. In women inflammation of the pelvic organs often spreads to the peritoneum. Apart from these, peritonitis may occur when the infection is brought by the blood-stream—pneumococcal peritonitis, for example. In all cases the inflammation is either *local—i.e.*, limited to the immediate neighbourhood of the ulcer, etc.—or *general—i.e.*, spreading over the abdomen. The latter is by far the more serious, though in either variety abscesses may form in any part from the pelvis to the diaphragm, while in the latter position it may spread through into the chest, causing an empyema.

The *symptoms* of general peritonitis usually begin suddenly, and include severe abdominal pain, especially about the navel; rapid and feeble pulse, and an elevated temperature. Vomiting begins early; constipation is the rule. The abdomen becomes distended with gas, moves not at all as the patient breathes, and is exquisitely tender. Meanwhile, the patient begins to show the exhausting effects of the disease in his sunken eyes and cheeks and his lead-coloured complexion. Death, unless prevented by operation, takes place within a few days. When the disease is only local, recovery may follow without the help of operative measures, and the same holds with pneumococcal peritonitis. If an

abscess forms, prompt operation is essential. This complication is likeliest to occur around the appendix or under the diaphragm, between it and the liver. The latter complication—**Subdiaphragmatic** or **Subphrenic Abscess**—requires a special word of explanation. Owing to the natural curves of the spine, the appendix, when a patient is flat in bed, lies almost at the summit of a curve, perched, as it were, at the top of a hill which declines one way into the pelvis, and the other into the hollow of the back, where the diaphragm is situated. Any septic material about the appendix is likely, therefore, to gravitate downhill; and, as a matter of fact, with the patient flat in bed, the gravitation takes place down the slope into the back, where a subphrenic abscess collects. But, by sitting the patient up, gravitation will conduct the septic material down the pelvic slope, and a pelvic abscess will form instead. Of the two abscesses, the pelvic is the less serious, is much the simpler to diagnose, and far easier to drain. Nowadays, therefore, in a case of appendicitis, it is the rule to prop up the patient in bed (Fowler's position) so that, if an abscess develops, it shall not be subphrenic.

Passing next to the chronic forms of peritonitis, two varieties are to be considered—tuberculous and malignant.

Tuberculous Peritonitis. — It was mentioned earlier that one of the channels for the absorption of food (and therefore, possibly, of micro-organisms) is by the lacteals. These are the lymphatic vessels from the intestines; but as they pass through a series of lymphatic glands in the abdomen (mesenteric glands), micro-organisms are likely to be checked at these points. Thus, tubercle bacilli swallowed by an infant in its milk often get thus far, producing *tuberculous mesenteric glands*, and from here the infection may spread directly to the peritoneum, causing tuberculous peritonitis. This latter affection may also originate from a tuberculous ulcer in the intestine spreading through to the

peritoneum, or from tuberculous pelvic disease in women, and in other ways. It is a chronic inflammation, producing a collection of fluid and matting the coils of intestine together. The latter development may, in its turn, lead to intestinal obstruction, while in cases arising from tuberculous ulcers of the intestine one of these may perforate and set up acute peritonitis. The symptoms of tuberculous peritonitis may begin acutely, sometimes simulating those of typhoid fever, but as a rule their onset is insidious — pain and swelling of the abdomen, loose bowels, and irregular fever —the patient loses ground, and many die from exhaustion or from general tuberculosis.

Malignant Peritonitis is usually the result of a cancer spreading to the peritoneum from the stomach, ovary, etc., and only exceptionally does it occur as a primary growth. The peritoneum becomes studded with little growths, and the abdomen fills with ascitic fluid stained with blood—a feature always suggestive of cancer when seen on tapping an abdomen. Death is inevitable.

Enteroptosis (or *Glénard's Disease*).—From what has been said of the peritoneum, it will be recognized that this membrane, wrapping round the various organs, helps to anchor them in their places. In Glénard's disease these attachments are so loose that when the patient stands up the viscera tend to drop down out of place, the lower part of the abdomen becoming prominent, the upper flat. The condition, which is commonest in women, and is likely to be accentuated if the abdominal walls have been previously stretched by repeated pregnancies, may cause little or no discomfort. But in neurotic subjects it may produce dyspeptic symptoms, dragging pains, etc. *Movable kidney* is one item in the trouble, which, if requiring treatment at all, is best corrected by an abdominal bandage or belt (see also p. 80).

CHAPTER XXI

DISEASES OF THE URINARY ORGANS

The waste products passing from the various organs into the blood must be excreted from the body, lest by accumulating they produce poisonous effects. Carbon dioxide, for instance, is excreted by the lungs, the bile by the liver, but other products, such as urea and uric acid, are disposed of by the kidneys. These organs are made up of numberless microscopic tubules, which, beginning blindly near the surface of the kidney, meander by a tortuous or convoluted course towards the root, or hilus, of the kidney, where they unite to open by a dozen or more mouths into the "pelvis" of the organ. These "convoluted tubes" are bathed on the outside by blood, from which they are able to extract various waste products, together with enough water to hold them in solution. This excretion, which is the urine, after trickling into the pelvis, drains away into a tube, the ureter—one to each kidney—which, running downwards at the back of the abdomen for about sixteen inches, opens into the bladder (see Fig. 17, p. 179). Here the urine collects, as in a reservoir, to be discharged from time to time along another tube—the urethra.

This simple physiological apparatus may be deranged in three ways. Either some obstruction to the urinary passages may interfere with the flow of the urine, in which case the fluid tends to become dammed back above the obstruction.

Or the urine itself may be chemically changed, and irritate the channels along which it flows. Lastly, the kidneys themselves may be affected until they are unable to perform their function of ridding the blood of its waste products. Each of these three pathological possibilities must be considered in turn.

First, an **Obstruction** to the flow. This is likeliest to come about if an abdominal tumour, lying near the ureter, presses on it, nipping it against the bones of the back or pelvis. Perhaps the commonest example of this is provided by pregnancy, when the uterus, enormously increased in size, may press heavily upon one or both ureters. In the same way cancer of the uterus is apt, in its later stages, to cause obstruction. Again, the prostate gland which lies underneath the bladder, with the urethra tunnelling through its middle, may, when it enlarges in old men, narrow the channel until micturition becomes almost if not quite impossible. Sometimes, however, the cause of the obstruction lies, not outside, but inside the urinary passages. Thus a calculus, in trying to escape from the kidney to the bladder, may block the ureter, or may lacerate it, and the tear, when it scars over, may contract until the passage is much encroached upon. Whatever the cause of the obstruction, however, the urine, being pent up in the kidney, accumulates under pressure. A striking result follows. The renal pelvis becomes overdistended, and ultimately the kidney itself wastes and disappears, its site being occupied by a sac of watery urine—a condition which will be described later under the name of "hydronephrosis" (see p. 177).

The second pathological change is a chemical alteration in the urine, making it irritating to the passages. Sometimes this change is produced by bacteria, either coming from the blood or gaining entry from without—on a dirty catheter, for example; in the latter event the bacteria ascend from the bladder along the ureters into the kidneys.

This **Bacilluria**, by decomposing the urine, is apt to inflame the bladder (*cystitis*), the ureter (*ureteritis*), the renal pelvis (*pyelitis*), and may even cause little abscesses in the kidney (*pyelonephritis*). It should be further noted that bacterial decomposition is specially likely to occur in urine which is stagnant on account of any of the forms of obstruction referred to above. Consequently, pyelitis and even pyelonephritis are to be numbered among the complications of pregnancy. Yet another chemical change, though how brought about is uncertain, leads to the crystallization of some of the salts in the urine, the crystals collecting together to form a calculus.

Lastly, the kidneys may fail in their normal function of excreting urine. This is commonly the result of **Inflammation** (nephritis), when the tubules, becoming severely damaged, can neither excrete the necessary waste products, nor, on the other hand, prevent the escape of blood-plasma (albumin), or even of blood itself. Nephritis, in its acute form, is brought about either by the agency of bacteria or of their toxins in the blood. In scarlet fever, for example, which, as is well known, is liable to be complicated by acute nephritis, the infection by micro-organisms, at first localized to the tonsils, becomes generalized, and, reaching the kidneys, inflames them.

As will be readily understood, the diseases of the urinary organs are likely to have an effect on the urine, and therefore an examination of the urine, chemical and microscopical, is of great value in revealing the existence of urinary diseases. In health the urine, excreted to the amount of 3 pints in the twenty-four hours, contains nothing but salts and water tinged with a yellow pigment; it is faintly acid, turning blue litmus-paper red; and its odour is characteristic. On account of the dissolved salts it weighs rather more than pure water, so that if a given quantity of water weighs 1,000 ounces, the same quantity

of urine would weigh 1,015 to 1,025 ounces—that is to say, the "specific gravity" of normal urine is 1010-1025.

In disease, on the other hand, the specific gravity may be as low as 1001 or as high as 1040. The amount excreted may vary from practically nil up to 30 pints daily. Furthermore, it may contain various abnormal constituents, more particularly albumin (a condition known as albuminuria), blood (hæmaturia), pus (pyuria), sugar (glycosuria), or bile (biliuria). These are to be identified by appropriate tests, a description of which will be given immediately.* Yet another feature of some pathological urines is the presence of "casts," which are recognized under the microscope. They are fragmentary casts of the inside of the convoluted tubules of the kidney, and are produced by some fluid such as blood oozing into a tubule, where it coagulates, the minute clot being then washed out by urine. Casts are formed nowhere except in the kidneys, and therefore bear testimony to disease of these organs.

Albuminuria.—Apart from the condition to be described later under the name of "functional albuminuria," albumin usually indicates disease of the kidneys; but it is also found in advanced heart disease, and temporarily in fevers of all kinds. It is identified by the two following tests—(1) *Heat Test:* Some urine which is slightly acid to litmus, either naturally or by the addition of two or three drops of weak acetic acid, is heated in a test-tube, or, rather, the top part of the test-tube is boiled, the lower half being allowed to remain cold. Albumin, if present, coagulates, making the upper part cloudy. This, however, is not conclusive, since phosphatic salts form a similar cloudiness when heated. To differentiate between the two, add a few drops of dilute acetic acid; if the urine becomes bright again the cloudiness is only phosphates, but if it remains turbid, albumin

* Glycosuria will be considered when diabetes is under discussion.

is certainly present. (2) *Nitric Acid Test :* A small quantity of pure nitric acid is placed in the bottom of a test-tube. A similar amount of urine is then allowed to trickle very gently down the inside of the tube (which should be tilted to one side for this purpose), so that instead of mixing with the acid it floats on the top. If albumin is present, a dense white ring of coagulated albumin forms within a minute or two at longest, where the two liquids join. To ascertain the amount of albumin in urine, *Esbach's method* is employed. Into a specially graduated Esbach's tube urine is poured up to the mark U, and to this is added some Esbach's reagent (picric acid) up to the mark R. On the two fluids mixing the albumin is precipitated. The tube is allowed to stand for twenty-four hours, after which the amount of albumin settled at the bottom is read off on the graduated side of the tube.

Hæmaturia.—Blood usually, but by no means always, points to disease of the kidneys or urinary passages. It occurs also in several general diseases, especially in anæmias. To *test* for hæmaturia, add a few drops of tincture of guaiacum to a little urine in a test-tube—a yellowish-white precipitate forming—and to this add a little ozonic ether, which floats on the surface of the urine; if a bluish-green colour develops at the junction of the two fluids, blood is present. Apart from this chemical test, which is exceedingly delicate, hæmaturia can often be recognized by detecting red blood-corpuscles in a drop of urine under the microscope.

Pyuria always signifies disease in the kidneys or urinary passages, the pus coming as a rule either from the bladder or from the pelvis of the kidney, though sometimes from the interior of the kidney. Since pus is not a chemical body, but a collection of dead leucocytes in a fluid derived from the blood-plasma, no really trustworthy chemical test is available, reliance being placed instead on the *microscopical*

examination, when the dead leucocytes can be easily recognized. Nevertheless, if a fair quantity of pus is mixed with urine, the following *test* is of use: To half a test-tube of urine add an equal amount of caustic soda solution; pour the mixture slowly into another test-tube and back again several times. If much pus is present, the liquid becomes viscid and stringy.

Biliuria can often be recognized with the naked eye, without the help of any chemical test, especially when, as in jaundice, a good deal of bile is being excreted by the kidneys. The urine then becomes deeply tinged with a greenish-yellow colour. The only chemical *test* in everyday use is that bearing the name of its discoverer, *Gmelin*, though even this is not very delicate. A few drops of impure nitric acid—*i.e.*, the yellow or "fuming" acid—are placed on a white background, such as a plate, while close by a similar quantity of the suspected urine is placed. The plate is then tilted until the two little islands of liquid run together. If at the line where they meet a bright display of colours—green, blue, red, and finally yellow—is seen, bile is known to be present.

We can now pass to a consideration of the several diseases of the kidneys and bladder.

Bright's Disease (so called after Dr. Bright, who in 1827 was the first to establish the connection between albuminuria, dropsy, and kidney disease), or **Nephritis**, is an inflammation of the kidneys, and occurs in three forms, one being acute and the other two chronic. *Acute nephritis*, though often developing as a complication of the specific fevers, especially scarlatina, diphtheria, and even measles and pneumonia, is not infrequent as a result of a chill. It affects patients of all ages. In a mild case the patient may notice nothing except that, on getting up in the morning, his face looks puffy, especially about the eyes; the urine, on analysis, contains albumin and perhaps a little blood,

while tube-casts are present. In a severer case the loins ache; the dropsy may be widespread, affecting the face, legs, and abdomen; while the urine is dark, probably bloody, and contains much albumin and casts. In the severest cases of all the dropsy is practically universal; the urine—that is to say, the few teaspoonfuls that escape from the kidneys—is practically pure blood; the patient's head aches, he feels faint and giddy, and perhaps is seized with epileptiform convulsions which leave him comatose (uræmia). These cases are often fatal, but the milder tend to recover in the course of weeks. Nevertheless, some permanent damage to the kidneys is more than likely. Such acute cases gradually pass into the second variety—namely, *chronic tubal nephritis*—the urine rarely, if ever, being free from albumin and casts, and the patient remaining liable to a return of the dropsy, or even to fresh outbreaks of the acute inflammation.

The third and commonest variety of Bright's disease, chronic from the beginning, is *chronic granular nephritis*, so called from the fact that the kidneys, becoming overrun with fibrous or scar tissue which gradually shrinks, lose the normal smoothness of their surface, which, instead, becomes puckered and irregular, as though studded with little granules. This disease is not very often seen in patients under middle age, and it affects men more often than women. Not a great deal is known of its causes, though gout and lead-poisoning are generally held responsible. Its onset is very insidious, the patient, indeed, scarcely realizing his health is being undermined until perhaps one of the many complications of the disease, such as apoplexy or uræmia, suddenly betrays the mischief. The earlier symptoms, however, include one or more of the following: Persistent headache, shortness of breath, nausea, dim sight, some puffiness of the face or œdema of the ankles, a feeling of weakness, anæmia. Perhaps the patient

finds it necessary to pass water more often than usual, having to be in and out of bed three or four times in the night. The urine proves to be of low specific gravity, but with only a trace of albumin—indeed, this may be entirely absent on some days—and tube-casts are to be found.

In each of these three varieties—acute, chronic tubal, and chronic granular—some important effects show themselves in the heart and circulation. The blood-pressure (see p. 47) is considerably raised, thus throwing extra work on the heart, which therefore enlarges. Subsequently the arteries become degenerated and rigid, this embarrassing the heart still more, until finally (though, perhaps, only in the course of years) cardiac failure develops in the manner described in an earlier chapter. At this stage the patient may therefore present the features rather of chronic heart disease than of Bright's disease. Yet another result of these circulatory disturbances has to be noted. The arteries, progressively degenerating, become unduly brittle, and, if the patient attempts some unwonted physical effort, are liable to burst. This accident sometimes happens in the eye, the hæmorrhage interfering with the sight; but an even graver result follows the rupture of an artery in the brain—namely, cerebral hæmorrhage; indeed, this complication, which is very common, is often the first indication that the patient has Bright's disease.

Again, nephritic patients, whatever the stage of their disease, are liable to what is known as *uræmia*. It is supposed that, with the kidneys inflamed and unable to excrete the waste products, poisonous substances accumulate in the blood, producing symptoms of either chronic poisoning (chronic uræmia) or acute poisoning (acute uræmia). Chronic uræmia is characterized by headache, nausea, vomiting, diarrhœa, and breathlessness (*i.e.*, the earlier symptoms of chronic granular nephritis). Acute uræmia

comprises convulsions, similar to those of epilepsy, ending in coma and perhaps death.

Lastly, another set of complications to which patients with Bright's disease are peculiarly liable includes pleurisy, pericarditis, bronchitis, and pneumonia. In fact, many cases terminate from these complications rather than from the kidney disease itself.

As to the *treatment* of nephritis, little being known of its causes, little can be done by way of prevention. Once established, however, it offers pretty definite indications for treatment. First, with a view to lightening the work of the kidneys, all protein food except milk is excluded from the diet. Next, with the idea of washing out the waste products that may have accumulated, ample fluid, particularly in the form of Imperial drink, is ordered; at the same time, and for the same purpose, the skin is encouraged to perspire, and the bowels are kept freely moved. In the event of acute uræmia developing, these measures must be supplemented by bleeding a vein, by injecting saline solution intravenously, or by hot packs and hot-air baths. Dropsy itself, though only a symptom, may require to be treated by needle-puncturing the skin or by inserting little silver drainage-tubes (Southey's tubes) under the skin, or, in the case of ascites, into the abdomen; though here, again, good results are likely to follow free perspiration and purgation, which help to carry off the excess of fluid. Of recent years attention has been drawn to the influence of common salt in producing dropsy, and a salt-free diet has been advocated to reduce œdema.

Eclampsia.—Closely related to nephritis is the condition known as "eclampsia," which sometimes complicates the latter part of pregnancy, often with fatal results. Reference has already been made to the pressure of the gravid uterus on the ureters, and the consequent obstruction to the passage of urine—a state favourable to the bacterial in-

fection of the urinary channels. In keeping with this, women, during the second half of pregnancy, sometimes develop slight œdema of the face and legs, complain of headache, dimmed sight (even temporary blindness), giddiness, and vomiting; and the urine when examined proves to contain albumin, tube-casts, and, in severe cases, blood. To this condition the name of *pre-eclamptic toxæmia* or "kidney of pregnancy" has been given. It is not often fatal, the symptoms subsiding after delivery. Its precise nature has yet to be established, but it is regarded by many obstetricians as a mild form of eclampsia.

Eclampsia proper, however, is altogether a more serious affection. After premonitory symptoms not dissimilar to those just enumerated, the patient is seized, either before, during, or after labour, with convulsions, epileptiform in nature. The temperature runs high, and jaundice often develops. The urine is diminished, even ceasing altogether, and albumin is present, together with renal casts and perhaps blood. The mortality is high, but should the patient escape with her life, her subsequent pregnancies are not likely to be affected in this way again.

The similarity between these symptoms and those of nephritis will have been noticed. Nevertheless, post-mortem examinations show that the kidneys are not inflamed as in nephritis, but rather that many of the kidney cells have been directly killed. Moreover, similar changes are to be found in the liver. The presumption, therefore, is that these organic changes are produced by the action of some toxin. The *treatment* of both pre-eclamptic toxæmia and eclampsia follows much the same lines as that of acute nephritis, with the important addition that, if the eclampsia precedes delivery, labour must be induced.

Functional Albuminuria.—Naturally enough, when the connection between albuminuria and nephritis was first established, albuminuria came to be regarded as of ill-omen.

Some thirty years ago, however, it was recognized that many young men and women, though passing albumin, presented none of the signs of kidney disease, and, in fact, were in perfect health. To this condition, which implies no organic trouble, the name of "functional" or "physiological" albuminuria was given. It is not very uncommon in adolescents, in whom it often shows itself after cold baths or in the nervous excitement produced by medical examination. In other cases the albumin is excreted, not when the patient is lying down—for example, in the night urine—but only when he is up during the day; for this reason the condition is sometimes called "orthostatic" (*i.e.*, standing upright) albuminuria. Yet another common cause is severe muscular exercise, as in athletics; thus, after the Boat Race one year the eight men of the Oxford crew all had albuminuria, and four of them to an excessive amount. The same thing has been found with soldiers after fatiguing marches.

Not only albumin, but even blood-pigment—hæmoglobin—may be present in the urine without indicating renal disease. In some people, after exposure to cold, the urine is brightly coloured with blood, perhaps for a few hours only, and though they may feel unwell at the time, the attack soon passes. To these paroxysms, which are likely to recur whenever the patient is chilled, the name of **Paroxysmal Hæmoglobinuria** has been given. The cause is unknown, though many cases occur in patients with Raynaud's disease.

Pyelitis and **Pyelonephritis**, already mentioned as effects of bacilluria and as complications of pregnancy and of cystitis, may also result from the irritation of stones in the kidney, and are sometimes caused by enteric fever and diphtheria. The symptoms, which are not always easy to identify, include pain and tenderness in the loins, high fever, and rigors; the urine contains pus, albumin, and bacteria. The patient may die, though this is to a large extent de-

pendent on the cause of the inflammation, and in the pyelitis of pregnancy recovery is the rule.

Renal Calculus.—Stones in the kidney are formed from the soluble urinary salts, which, for a reason not always understood, are liable to crystallize out of the urine, forming minute particles of "gravel" or "sand." Fresh crystals cluster round these as nuclei, until finally calculi as big as peas and bigger are formed. Chemically, these calculi are usually composed of uric acid, oxalate of lime, phosphate of lime, or of a mixture of these salts.

Should such a calculus escape from the kidney, its passage down to the bladder, during which it overstretches or even tears the ureter, is likely to cause agonizing pain (*renal colic*) until it falls out below into the roomy bladder; while the laceration inflicted in this progress is responsible for the associated hæmaturia. If, on the other hand, the calculus should get stuck in the ureter, unable either to slip back into the kidney or to advance into the bladder, the passage will be obstructed, and the urine, unable to get past, will collect under pressure in the renal pelvis, distending it, and will lead, as has been explained, to **Hydronephrosis** (Fig. 16). This may contain so much fluid as to become a large abdominal tumour. An interesting fact about a tumour of this nature is that it may suddenly disappear, the patient at the same time voiding an excessive quantity of urine. The explanation, of course, is that the calculus has shifted, removing the obstruction, and the hydronephrotic urine has poured down into the bladder. In cases, however, when the obstruction remains permanent, the stagnant urine in the hydronephrosis will probably become septic, a condition now called **Pyonephrosis**. Lastly, even when a renal calculus is too large to enter the upper end of the ureter, and remains in the kidney, it may easily cause pyelitis or pyelonephritis.

Once in the bladder a calculus can usually make good its escape along the elastic urethra to the exterior—a not

unsatisfactory ending to a condition with so many serious potentialities. But if retained anywhere in the urinary tract, the only effective treatment, since no medicinal solvent is known, is by operation, the calculus being first located by the X-rays. On the other hand, medicinal treatment can

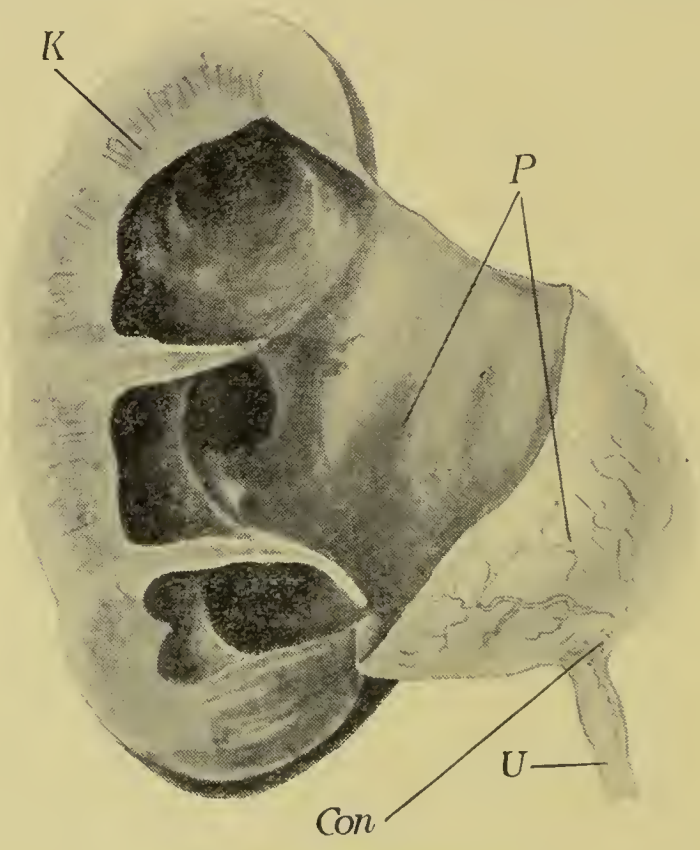

FIG. 16.—HYDRONEPHROSIS.

One half of a hydronephrotic kidney, showing only a rind of kidney substance (*K.*) and a greatly distended pelvis (*P.*) as a result of a constriction (*Con.*) at the upper end of the ureter (*U.*). Compare this with Fig. 17.

assist in preventing a calculus forming in the first place; of particular service are alkaline drinks, which, promoting a copious flow of dilute urine, prevent the crystallization of the urinary salts.

Perinephric Abscess is the name given to any abscess

forming round the kidney. One of its commonest causes is pyelonephritis, but it may also occur in pyæmia and in any local inflammation of the neighbouring organs.

Renal Tuberculosis is often a late development of tuberculosis of the bladder, the infection spreading up the

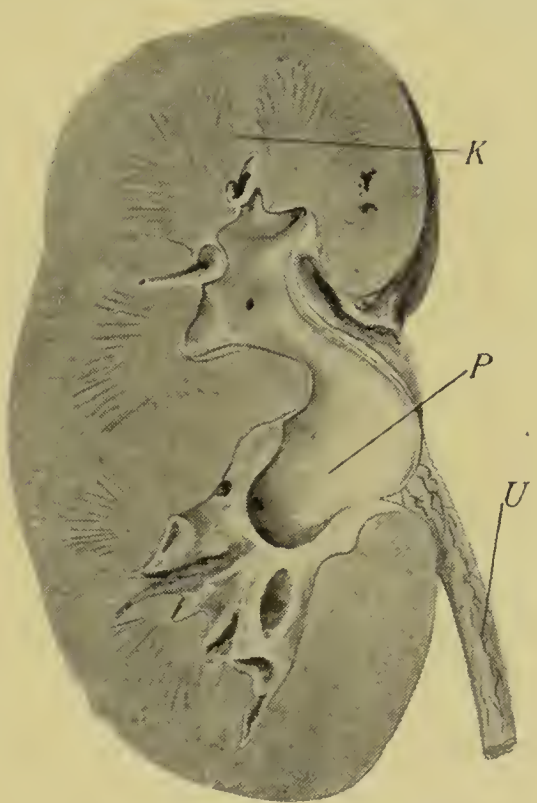

FIG. 17.—HEALTHY KIDNEY.

One half of a healthy kidney (*K.*), the urine from which collects in the pelvis (*P.*) and drains into the ureter (*U.*).

ureters. The kidney undergoes a gradual transformation into caseous material, and during the process the urine coming from it contains pus, albumin, tubercle bacilli, and perhaps blood. If both kidneys are infected, this gradual destruction is likely to cause uræmia.

In view of the occasional necessity, both in tuberculosis and other kidney affections, of removing the diseased organ,

it is a very important matter to make sure that the other kidney is healthy; otherwise the patient, being left with an only kidney, and that diseased, may rapidly sink into uræmia and die. To decide the point prior to operation, a cystoscope—an instrument for viewing the inside of the bladder—is passed along the urethra, and the urine trickling in at each ureter is watched, or, better still, a fine catheter is passed into each ureter. In this way the urine coming from each kidney is kept separate for analysis, and an opinion can be formed as to the state of each kidney.

Malignant Tumours are not common, but may grow to form large abdominal tumours. Being liable to bleed, they soon cause hæmaturia, the other symptoms being pain in the loin, and wasting. Unless removed by operation while still comparatively small (but therefore not easy to recognize) they are generally fatal.

Movable Kidney.—Some reference was made to this condition in an earlier chapter when discussing Glénard's disease. A few additional facts must now be noted. The kidneys, lying at the back of the abdomen on either side of the vertebral column, are largely kept in position and prevented from slipping down out of their place by an ample padding of kidney-fat surrounding them. In thin subjects, therefore, particularly in those who have been rapidly getting thin, this support is withdrawn, and one or both kidneys tend to become displaced. Many people with movable kidneys, however, have no knowledge of the fact, the condition causing no symptoms. Others, however, are conscious of a dragging pain, or a feeling of weight in the loin, which is eased by lying down. A few experience attacks of acute pain, perhaps severe enough to cause vomiting, while the urine passed at the time is high-coloured and even contains blood. These attacks—known as Dietl's crises—are accounted for by the kinking of the ureter and perhaps renal vein, when the kidney gets out of its place, which interferes

with the escape of the urine and obstructs the return flow of blood from the kidney.

If any symptoms are present and call for treatment, a bandage and pad, or an abdominal belt contrived to hold up the kidney, may be worn. In severe cases an operation may be necessary to anchor the kidney in position, but even this may fail in bringing relief, especially as many of the cases occur in neurotic subjects.

Diseases of the Bladder.

Though these are mainly of surgical interest, some have important medical bearings.

Cystitis (*Inflammation of the Bladder*).—In this condition, which has been referred to earlier (p. 168), the lining membrane of the bladder becomes inflamed, usually as a result of infection by septic organisms. Thus it often develops in nervous cases with bladder-paralysis when catheterization has become a routine necessity. In other instances the infection is brought down in the urine from the kidney, as in pyelitis. The *symptoms* are pain in the bladder (*strangury*) and a frequent and urgent desire to micturate as soon as a few drops of urine have collected in the inflamed organ. In the acutest forms the temperature is likely to be high. Chronic cystitis, which may follow the acute variety, has similar though milder symptoms; but the urine, becoming decomposed in the bladder, is often foul-smelling and strongly alkaline to litmus-paper. Whether acute or chronic, the *treatment* comprises washing out the bladder, a restricted diet in which milk fills a prominent part, and the administration by the mouth of antiseptic drugs such as urotropin, which are excreted by the kidneys.

Irritability of the Bladder.—Occasionally, though not on account of any cystitis, the bladder is too irritable to retain urine, and micturition therefore becomes distressingly

frequent. The trouble may depend on an excessive acidity of the urine—in which case drugs will be needed to make it more nearly alkaline—on Bright's disease, or on pelvic disease; but in women it is often a neurotic symptom, dating perhaps from some occasion when an urgent desire to micturate had to be resisted.

Incontinence, or *Enuresis*, has already been mentioned in connection with diseases of the spinal cord, but is much commoner as a functional condition, especially in childhood. At that age, when the natural control over the bladder has not yet been firmly established, the urine is apt to be passed during sleep (*nocturnal enuresis*). This is a habit for which a child is in no way blameworthy, and is likely to outgrow, but before a decision is come to, certain organic causes should be inquired into. Thus bed-wetting is a frequent result of adenoids, which, by obstructing the breathing and producing during sleep a condition of half-suffocation, may provoke contraction of the bladder. Among the other causes held responsible are thread-worms, a tight prepuce, and a stone in the bladder.

CHAPTER XXII

DISEASES OF THE BLOOD

On more than one occasion in earlier pages reference has been made to the condition of the blood in local diseases —for example, in local bacterial infections, when toxins or even micro-organisms themselves are found in the blood— but such a condition is not to be regarded as a "disease of the blood," since, properly speaking, it is merely the secondary result of disease elsewhere. Only when the blood is primarily at fault can this term be rightly applied; and in such cases, as will be pointed out immediately, the disease of the blood is likely to produce striking and widespread secondary effects in many organs of the body.

Normal blood, of course, consists of a clear straw-coloured fluid—the plasma—in which float myriads of corpuscles, red and white. The plasma itself, though 90 per cent. water, contains some 8 per cent. of nourishing proteins (albumin and globulin). The red corpuscles, infinitely small—a single drop of blood contains nearly 300,000,000 of them— are composed of a red pigment—hæmoglobin—which contains iron, and which, as the corpuscles pass through the bloodvessels of the lungs, chemically seizes upon oxygen to convey it for use in distant parts of the body. It is these red cells that give blood its characteristic colour, and, showing through the skin, make the complexion pink.

They are manufactured by the marrow of the bones, and probably by the spleen, but are only short-lived, their pigment being ultimately excreted as the green colouring matter of bile (see p. 158). The white corpuscles, or leucocytes, on the other hand, differ in most respects from the red, which exceed them numerically in the proportion of 500 to 1. They are living cells, not unlike amœbæ, the lowliest representatives of animal life, and they are largely occupied in ridding the blood and the body generally of any harmful organisms that gain entry to the system. They take origin, most of them at any rate, in lymphatic glands, and in any organs containing lymphatic-gland tissue, such as the spleen and thymus.

In view of the foregoing it will be desirable, when considering the diseases of the blood, to include under that heading the diseases of the blood-forming organs—*i.e.*, the bone-marrow, spleen, and lymphatic glands. Before coming to the several diseases, however, it may be said that in all blood affections one of the most striking effects is often a greater or less degree of **Anæmia** — *i.e.*, bloodlessness. That this should be the case is readily understood when it is mentioned that the red cells usually suffer heavily, excessive numbers of them becoming destroyed and excreted in the bile, with the result that the blood, now deficient in hæmoglobin, loses much of its healthy colour—an effect revealed in the pallid and even waxy face, lips, and finger-nails. But this impoverishment of the blood shows itself in other directions. For want of enough oxygen to aërate the tissues, the patient is habitually short of breath, trying to make up by quick breathing for the lack of oxygen in the circulation. Further, the tissues being on short commons in respect to oxygen, are likely to become clogged with fat, for the combustion of which no sufficient oxygen is forthcoming. This is especially serious when, as often happens, the heart becomes fatty, and dilates. The patient now

suffers from palpitation, giddiness, and even syncopal attacks, while the ankles may swell, as in cases of heart disease. Finally, if the anæmia is severe, bleeding may occur from almost any part of the body—nose, gums, stomach, bowels, kidneys—or as a purpuric rash under the skin.

These, then, are the chief symptoms denoting anæmia; but to what is the anæmia itself due? Anæmia, of course, is not a disease in itself, but a feature of several diseases. Thus it may be secondary to the loss of blood from an accident, an operation, or hæmatemesis; it may come from starvation or from the physical exhaustion of suckling a child too long; it is common in syphilis and Bright's disease, as well as in cancer and phthisis; it results from lead and arsenical poisoning; it follows many acute infective diseases, from enteric to tonsillitis. In all these instances we are dealing with what is called *secondary* anæmia. But there are two forms of anæmia which are *primary*, or "essential"—namely, chlorosis and pernicious anæmia.

Chlorosis.—This is the disease so frequently seen in girls and young women between the ages of fourteen and twenty. Precisely what the cause is cannot be said, but almost all the patients are habitually constipated, and once this is overcome, the chlorosis usually disappears. The pathological change is an excessive destruction of the red blood-cells and hæmoglobin, and the symptoms, which in the main are those already mentioned as due to anæmia, include lassitude, headache, giddiness, fainting, shortness of breath, and indigestion; the menstrual periods fail to show themselves, or, after appearing for a time, may cease. The diagnosis of these cases may be facilitated by an examination of the heart, when suggestive alterations in the heart-sounds can often be heard. Chlorosis is not a disease that is often accompanied by any serious, still less fatal, complications, and most cases recover under suitable treatment,

though taking some three or four months about it. This treatment, apart from general hygienic measures, especially with reference to fresh air and good feeding, requires the administration of suitable aperients to overcome the constipation, together with iron tonics to promote the development of new red corpuscles.

Pernicious Anæmia is an altogether more serious affection, the majority of cases ending fatally within a year or so of the onset. It is a disease of middle life, which attacks men rather more often than women. Though the cause is uncertain, there is reason to believe that it is not unconnected with poisonous substances which, absorbed from the stomach and intestines, exert a destructive effect on the red cells and bone-marrow. The pallor of the patient is lemon-tinted rather than white, and the face and lips are often strikingly bloodless—a not surprising result since, in severe cases, 90 per cent. of the red cells may be destroyed, while a 50 per cent. destruction is not at all out of the ordinary. The distinction between this disease and chlorosis is made by a microscopical examination of the blood. The symptoms are those of severe anæmia, except that nausea, vomiting, and diarrhœa are the rule, while an irregular febrile temperature reaching to 102° or 103° F. is not unusual. The treatment, in view of our uncertain knowledge of the cause of the trouble, is often unsuccessful, but the most reliable drug is arsenic, many cases having improved from its use.

At this point a few words may be given to a condition which, though uncommon, is clinically related to other anæmias. In **Splenic Anæmia** the blood is affected in a way not very dissimilar to that in chlorosis, though more severely; but, in addition, the spleen enlarges to five or ten times its proper size, and can be easily felt as an abdominal tumour. The cases run a variable course, often for many years, the symptoms being those of anæmia, but ultimately

the liver may become cirrhotic, in which event ascites and jaundice mark the approach of the end.

We now pass to another group of blood diseases, in which may be placed the four following conditions—purpura, hæmophilia, scurvy, and infantile scurvy.

Purpura.—Mention was made a little earlier of a purpuric rash as a result of anæmia. Purpura is the name given to any rash produced by hæmorrhages into the skin; the spots, which at first are bright red, darken, become brown or greenish, and fade like bruises. In point of fact, purpura is rather a symptom of disease than a disease itself, and merely indicates a pathological state of the blood. Though occurring in all blood diseases, it is most common in rheumatic fever, but is not infrequent in the specific fevers, especially scarlatina and smallpox, while sometimes it occurs in Bright's disease, cirrhosis of the liver, infective endocarditis, and other septic conditions. In its severest form it appears not only in the skin, but as hæmorrhages beneath the various mucous membranes — nose, mouth, stomach, intestines, uterus, bladder — in the kidney, and even in the brain. One form, known as **Henoch's Purpura**, occurs particularly in children, when, in addition to the purpuric rash, the joints become swollen and painful, and abdominal pain and vomiting develop. The prognosis and treatment of purpura depends, of course, rather on the nature of the underlying disease than on the rash itself.

Hæmophilia is one of those interesting constitutional conditions which are transmitted from parent to child. Hæmophilic blood lacks the normal property of clotting; consequently the patients themselves are liable, even on slight injury, to bleed profusely and perhaps fatally—the mere extraction of a tooth may be followed by so copious a loss of blood as to reduce the patient to a condition of serious anæmia. The remarkable circumstance about the disease is that, though women usually escape it, it is the

mother who transmits it to her (male) children, she herself remaining seemingly unaffected. The reason for this is not known, nor, indeed, why the blood should be slow to clot. Various drugs have been employed to relieve the condition, but with no great success; nevertheless, since the patient may easily be brought into extreme danger from hæmorrhage, prompt measures for stanching the loss of blood must be employed.

Scurvy (*Scorbutus*).—This disease used to be a veritable plague among seafaring men in the days of sailing-ships and long sea-voyages, when for months together no fresh food could be had; but nowadays it is rare. It is caused by the want of fresh vegetables, a supply of which prevents or cures the disease; and by the regular use of lime-juice it has been practically abolished from the naval and merchant services. The disease begins insidiously, at first with nothing more than lassitude and physical weakness, but in a week or two the gums swell until they overhang the teeth like purplish, fleshy curtains, becoming tender and bleeding readily. The teeth loosen and drop out, the tongue swells, and the whole mouth grows foul and the breath fœtid. Simultaneously with these changes a purpuric rash appears on the legs and elsewhere, and hæmorrhages may take place into the eyelids and from the nose and other parts of the body. In severe cases deeper-lying hæmorrhages form over the bones, causing lumps, especially about the knee and over the jaw. By this time the patient is very anæmic, and, what with blood under the eyelids, a puffy face, and purpuric spots, presents a characteristic appearance. As already mentioned, the essential treatment is dietetic—fresh fruit and fresh vegetables.

Infantile Scurvy is the same condition as the above, but occurring in the first year of life and as a result of over-zealous attention to an infant's dietary, from which everything is excluded that has not been sterilized, nothing fresh

or unboiled being given. And since this sterilization is only a modern practice, infantile scurvy has been known only some twenty years.* At one time the inappropriate name of " scurvy rickets " was given to it in the belief that it was a special form of rickets, but this is not the case, and the disease has nothing to do with rickets. As might be supposed, it is more likely to be found in the nurseries of the well-to-do, who can afford to take every precaution to exclude unsterilized food from a child's dietary, than among the poor, who may be content to run the risks of unboiled milk. The symptoms are not dissimilar to those of adult scurvy, except in two respects. If the infant is without teeth, the gums do not become spongy ; and, secondly, hæmorrhages may occur in a bone where the shaft joins the extremity (or epiphysis), in which case the epiphysis becomes detached from the shaft, as though fractured ; movement now becomes so painful that the child allows the limb to lie as if paralyzed, and screams when it is touched.

To complete this account of the blood diseases some description must be given of two conditions, Hodgkin's disease and leukæmia, in which the blood-forming organs —the lymphatic glands, spleen, and marrow—are largely involved.

Hodgkin's Disease or *Lymphadenoma*.—In this disease, which is a good deal commoner in men than women, the lymphatic glands enlarge all over the body until they form great masses, perhaps obstructing bloodvessels and causing œdema, or pressing on nerves and setting up pain or paralysis. At the same time a progressive anæmia develops ; this is mainly due to the destruction of the red cells, which become reduced to about half their normal number. The glandular swelling begins as a rule in the neck, subsequently affecting the armpits

* In earlier days, however, babies suckled by scorbutic mothers have been known to become scorbutic themselves.

and groins, and finally spreading to the more deeply lying glands in the chest and abdomen. In most cases the spleen is moderately enlarged.

The *symptoms* fall into two groups—those due to anæmia, details of which were given on an earlier page, and those

FIG. 18.—SPLEEN FROM A CASE OF HODGKIN'S DISEASE.
The organ is about half as large again as in health, and the numerous pale areas represent growths of lymphatic tissue.

resulting from the pressure and obstruction by the masses of glands. The latter symptoms vary—for example, if the glands press on the œsophagus, swallowing will be interfered with; if on the trachea, there will be difficulty in

breathing, perhaps calling for tracheotomy; if on the principal veins from the arms or legs, the corresponding limbs will become swollen and œdematous; if on the abdominal vessels, ascites may be the result; in the chest the effects are those of a mediastinal tumour; and so on. The *prognosis* is far from good, most of the cases ending fatally, the more acute in three or four months, the more chronic in as many years. As with pernicious anæmia, arsenic is the drug offering the most hopeful results.

Leukæmia or *Leucocythæmia*, so called from the excessive number of leucocytes or white cells which the blood comes to contain, is, like lymphadenoma, a disease of the blood-forming organs. In some cases, however, it is the lymphatic glands which are affected, in others the spleen and bone-marrow; and the differences between the two varieties warrant the recognition of two types of the disease —namely, lymphatic leukæmia and spleno-medullary leukæmia.

Lymphatic leukæmia begins, like Hodgkin's disease, with a gradual enlargement of the lymphatic glands, and a progressive anæmia associated with a destruction of the red cells. Its distinguishing feature, however, lies in the microscopical characteristics of the blood, which teems with white cells, forty or fifty times as numerous as in health, whereas the blood in Hodgkin's disease shows no such change. The symptoms of lymphatic leukæmia are in part those of anæmia, in part those of obstruction and pressure by the swollen glands. The course of the disease, though towards a fatal ending, is very variable, sometimes running for a few years, but often terminating within a few weeks, especially in young subjects. It is but little affected by treatment, though arsenic has the reputation of favourably influencing it.

In *spleno-medullary leukæmia* the blood swarms with even more white cells than in the lymphatic variety, and may

indeed contain as many white as red cells—*i.e.*, the white may be 400 to 500 times as numerous as in health ; in no other disease is this excess known to occur. A further striking feature is the enormous growth of the spleen, which, instead of being a small organ, weighing a few ounces and tucked away under the ribs, becomes the heaviest organ in the body, weighing several pounds and filling half the abdomen or more as a hard, massive tumour ; in no other disease does the spleen attain such large proportions. The third feature of the disease, though seen only post mortem, is the altered condition of the bone-marrow, which, losing its healthy pink colour, becomes brownish-red, like blood-stained pus. The symptoms are mainly those of anæmia, and the prognosis and treatment do not greatly differ from those of lymphatic leukæmia.

CHAPTER XXIII

DISEASES OF THE DUCTLESS GLANDS

UNDER the name "ductless glands" are included several organs which, unlike, for example, the salivary glands and kidneys, are unprovided with ducts; their secretions are discharged direct into the circulation, and for this reason are called "internal" secretions. The chief of these glands are the adrenals, the pituitary, the thymus, and the thyroid. Though their physiology is still imperfectly understood, it may be said briefly that they play a significant part in promoting and controlling the growth of the body and the functions of other organs.

The adrenal, or *suprarenal glands*, lying one against each kidney, secrete a substance which acts powerfully on arteries. It will be recalled from the account of diseases of the bloodvessels that the arteries are contractile tubes; the adrenal secretion stimulates them to contract more tightly, with the result that the passage of blood through them is diminished and the blood-pressure rises. Thanks to this action, preparations of the adrenal glands have come widely into clinical use, under the name of "adrenalin," "suprarenal extract," etc., to allay bleeding; dabbed on a bleeding surface, the extract stems the hæmorrhage by contracting the bleeding vessels.

In health the adrenal secretion is available for maintaining blood-pressure, but if the secretion ceases on account

of disease, the blood-pressure falls. This, therefore, is a prominent feature of **Addison's Disease**, which is an affection of the adrenals. With the blood-pressure falling low, the pulse and action of the heart are feeble, the patient suffers much from physical weakness, is liable to faint even on so moderate an exertion as sitting up in bed; he is easily put out of breath, and feels his heart beating distressingly with the slightest excitement. In a word, he presents a picture of extreme languor and debility, without, however, complaining of any pain. These rather vague symptoms might well escape diagnosis if it were not for a more noticeable change in the skin, which grows dark and pigmented. This change affects first the exposed parts (face and hands), then the nipples, genitals, and armpits, which are normally dark, and the parts pressed on by garters, waistbelt, or braces, and finally spreads all over the body until the patient may be as dark as an Indian. Yet another suggestive symptom is vomiting, which is rarely wanting. The disease is usually fatal—in some cases, indeed, before the characteristic pigmentation has appeared—and post mortem the cause of the trouble is found to be tuberculosis of the adrenal glands. It is an interesting but disappointing fact that suprarenal extract, though so active physiologically, seems to possess no beneficial influence on the disease.

Yet another adrenal affection—and this a very curious one—deserves mention. In young children certain cancerous tumours, called **Hypernephromata**, occasionally grow in the adrenal glands. Their effect is to bring about a precocious sexual development, so that a child of, say, three or four, may present the physical development of a grown man or woman; indeed, in some of these cases menstruation has begun before the end of the first year of life.

The *pituitary* is a small gland the size of a hazelnut,

hanging by a hollow stalk from the under-surface of the brain, and lodged in a recess in the base of the skull. It consists of two lobes, front and back, united by a thin intermediate layer. These lobes, which are very dissimilar in appearance under the microscope, are unlike in function. The hind lobe, together with the intermediate part, is concerned in elaborating a secretion which, escaping up the hollow stalk into the central cavities of the brain, mixes with the cerebro-spinal fluid. If, as a result of disease, this secretion is deficient, a state known as **Hypopituitarism** results, the symptoms being referable to the nutrition of the body and to the sexual functions. The patient becomes stout, even obese, the sexual organs resume their infantile characters, the puberal hair is shed, the menses cease, and sexual desire is lost. A curious feature of the disease is shown in the increase in the amount of sugar the patient can consume and retain in the system without any appearing in the urine. Subjects of hypopituitarism who are still children at the onset of the disease become inordinately fat, and fail to show signs of the usual sexual developments of puberty.

It is the secretion of the front lobe of the pituitary, however, which has the greater pathological interest. If, as sometimes happens, the lobe enlarges to form a tumour, an excessive quantity of secretion is produced which sets up a condition of **Hyperpituitarism**—better known under the name of **Acromegaly**. This disease, which usually begins in early adult life, is characterized by a remarkable overgrowth of certain of the bones, especially of the hands, feet, and face. The hands and feet become very big, out of all proportion to the body, the patient requiring to take much larger sizes in gloves and boots. At the same time the bones of the face increase in size, the lower jaw becoming particularly big and heavy, and projecting beyond the upper, while the teeth become widely separated. Further,

as the pituitary tumour grows slowly larger, it produces severe headaches, and, by pressing on the optic nerves, a progressive blindness.

If, however, the condition begins in childhood before the bones are set, the overgrowth is not restricted to the three parts mentioned, but affects the whole of the skeleton. The patient far outstrips the normal limits of growth, and may well become 7 or 8 feet high. In fact, it is now known that many giants, such as O'Brien, the Irish giant, whose height was 8 feet 4 inches, are really cases of tumour of the front lobe of the pituitary gland beginning in childhood.

The *thymus gland*, an organ with much the same structure as a lymphatic gland, and lying behind the sternum and in front of the great bloodvessels, is not known to play any very prominent part in disease. Except in early life, when it is fairly big, it probably has no great physiological importance, and in most adults has dwindled almost to nothing. Sometimes, however, it becomes enlarged by malignant growth, in which case the symptoms are those of a mediastinal tumour; but a more important affection is that known as **Status Lymphaticus**, which has attracted a good deal of attention as a cause of sudden death under anæsthetics. This condition, however, produces no symptoms, and therefore cannot be recognized beforehand, but post mortem the thymus is found to be enlarged, as are all the lymphatic glands of the body.

The *thyroid gland*, the largest and most important of the ductless glands, lying in the neck on either side of the trachea, is subject to several diseases, of which the most important are myxœdema, cretinism, exophthalmic goitre, and simple or parenchymatous goitre.

Myxœdema is the condition produced when the function of the thyroid is suppressed either by disease or by the surgical removal of the gland. The patient, usually a woman, grows bulky in body, the face becoming bloated and

coarse, the hair falls out, and the skin grows dry and harsh. She becomes slow in thought and speech, defective in memory, and sluggish in movement. The disease is slowly progressive, and, if untreated, reduces the patient to a condition of extreme dullness and apathy, and is finally fatal. But these later stages are not often seen now that the cause is known; for provided the symptoms are recognized in time, and thyroid extract is given by way of treatment, the patient probably recovers completely. But if at any time the treatment is discontinued, the symptoms recur. Myxœdematous patients therefore require to take the extract for the rest of their lives.

Occasionally children are born without the thyroid gland, and in the course of a few months develop very similar symptoms to the above, the condition being known as "congenital myxœdema," or **Cretinism.** This differs from the adult form in two important respects. In the first place, the mental development is retarded and the child becomes mentally defective—cretins, of course, form a well-recognized class of idiots. Secondly, the physical growth becomes almost as backward as the mental, the cretin remaining small and stunted. Nowadays, however, with thyroid extract available as a cure, these severer examples of cretinism are not so often met with, but twenty years ago, when the condition was not understood, it was no uncommon thing to see cretins in their third and fourth decades who were no taller and were less intelligent than children of three or four.

Exophthalmic Goitre (*Graves's Disease*) is in most respects the exact reverse of myxœdema—a fact which suggests the cause of the disease as an excessive secretion of thyroid material, perhaps of a pathological quality. The two striking features to which the disease owes its name are the enlargement of the thyroid to produce a goitre, and the bulging of the eyes. But hardly less noticeable is the

patient's extreme excitability of temperament—a change which accords well with many of the other symptoms, such as tremulous hands, rapidly beating heart, throbbing arteries, flushing of the face, moist skin, and looseness of the bowels. The disease, the cause of which is unknown, afflicts women more often than men, and, though not as a rule fatal, is very refractory to treatment, the most important items in which are probably rest and quiet. The surgical removal of the gland may ameliorate the symptoms, but the subjects of exophthalmic goitre stand operations very badly.

Finally, a word may be added on Simple or **Parenchymatous Goitre**. This is a swelling of the thyroid gland, or of a part of it, which often attains much larger proportions than in the exophthalmic variety; but it produces no symptoms other than by pressure on the trachea and neighbouring parts. It results from drinking impure water, particularly of wells, ponds, and streams, which is, presumably, infected by a parasite. The condition often subsides provided the patient secures a supply of uninfected water, or, if the tumour is not old-standing, by the medicinal use of iodine. The more chronic cases, however, when the goitre has become large, may require surgical treatment, the removal of the tumour in these cases being unattended by any special risks.

CHAPTER XXIV

RHEUMATISM AND DISEASES OF THE JOINTS

UNDER the popular term of "rheumatism" are included many affections of the joints, which, medically speaking, differ in their causes, symptoms, and results. But until quite recently, when bacteriology took the matter in hand, they remained an ill-defined and but little understood group. Step by step, however, the fact has been established that micro-organisms are at the root of most of these diseases, and even in those cases in which this has not as yet been definitely proved, the weight of evidence is on the same side. Already enough is known to justify the prophecy that the various rheumatic affections will finally be classified among the infections.

Before going further into this matter, however, let us glance at the structure of a joint. It marks the site of union, or rather of articulation, of at least two bones—such as the femur and tibia at the knee—the ends of which are held together by tough but flexible ligaments passing from one to the other. But in order that the two bones may move smoothly on each other, each is capped with a thin layer of cartilage or gristle, the surface of which is kept moistened by a thick, almost oily fluid, secreted by a membrane (synovial membrane) lining the inside of the joint. In a word, a joint is a synovial bag or sac, strengthened on the outside by ligaments, and containing the lubricated,

cartilage-capped ends of the bones. Its mechanism is simple—one bone sliding on the other—and, short of dislocation or fracture, is not easily upset. Its vulnerability, however, lies in another direction, for being dependent for nourishment on its blood-supply, a joint is always exposed to the risk of infection by the blood-stream. And here, in point of fact, is the explanation of rheumatism—infection by organisms or their toxins—the resulting inflammation being known as "synovitis" in the milder forms, and as "arthritis" (*arthron*, a joint) in the severer.

To look from this standpoint at some of the principal forms of articular disease, it may be recalled that it is just over thirty years since Koch announced his discovery of tubercle bacilli in what at that time was known as "fungating joint disease," but subsequently as "tuberculous joint disease." Since that time the bacterial nature of other articular affections has been kept well in mind, and one by one their specific nature has been established. Thus, in many cases, rheumatism is secondary to gonorrhœal urethritis or vaginitis; in others to septic organisms which have entered the circulation from some local focus. Within the last few years pneumococcal arthritis, and even influenzal arthritis, due to the pneumococcus and the bacillus influenzæ respectively, have been recognized. These discoveries have shed light upon a great number of hitherto unexplained joint diseases, but there still remain many the exact bacterial origin of which is not conclusively established. For example, acute rheumatism itself and rheumatoid arthritis (or, to give it its more appropriate name, osteo-arthritis) are still only partly solved problems, but enough is known about them to make it pretty certain that they, too, are infective—a conclusion of cardinal importance in their prevention and cure.

Acute Rheumatism (*Rheumatic Fever*).—This disease, though by no means uncommon in children, particularly

affects young adults. It usually begins acutely, even suddenly, the articular symptoms being among the earliest. One or more joints become painful, swollen with synovial fluid, and intensely tender, while the overlying skin is marked by a pink flush. Even more characteristic of the disease, however, the pain and swelling fly, as it were, from one part to another, being now in the knee, then in the shoulder, then in the wrist, and so on, perhaps never staying more than a few hours in one joint. Meanwhile the patient is feverish, with a temperature of 102° to 103° F., and the skin is damp with perspiration, which is sometimes indeed so profuse as to cause a sweat-rash. After ten days or so the symptoms abate, and by the end of a fortnight the patient is probably well except for anæmia, which often follows in the wake.

This represents a straightforward case, but very often the course is complicated. Frequently the onset is marked by tonsillitis, and not uncommonly a purpuric eruption appears on the shins, and perhaps elsewhere. But these are comparatively unimportant developments, a far more serious complication being acute endocarditis. Roughly, in one case out of two, the valves of the heart, particularly the mitral, become inflamed and studded with vegetations, the result being mitral regurgitation. Sometimes these vegetations may become absorbed without leaving any permanent damage, but only too often they lead to chronic endocarditis, and the patient must henceforth be numbered among the cases of valvular disease of the heart, which of course, in months or years, is likely to lead to heart failure and all that this entails. Rheumatic fever, therefore, stands as one of the most serious diseases, not indeed in itself, but because of this devastating legacy; and it is only now beginning to be generally realized what large numbers of children are crippled by it, and their lives brought to a premature close. And the disease is all the more to be

feared since the severity of the rheumatic attack is no measure of the risk of endocarditis—so much so that an attack in a child, which, literally, may be nothing more than "growing-pains," and as such attracts little or no attention, may nevertheless be the cause of permanent heart disease.

Nor does this exhaust the catalogue of dangers, for yet another grave complication must be laid to its charge—namely, **Chorea** (St. Vitus's dance). The connection between these two conditions, though imperfectly understood, is pretty intimate, as shown by the facts that many cases of rheumatic fever develop chorea, many cases of chorea develop rheumatic fever, some cases of scarlatinal rheumatism develop chorea, and, finally, chorea, like rheumatic fever, is often complicated by mitral endocarditis. Its symptoms amount to little more than the involuntary twitchings which are so well known as a feature of the disease, though in the severest cases mental symptoms, including even mania and coma, may show themselves. The gravity of the disease lies in the risk of endocarditis. An attack rarely subsides under three months, and is but little amenable to medicinal treatment, though arsenic enjoys some reputation in this respect. More important, probably, are rest and isolation.

To return to rheumatic fever. It is, as has been mentioned, almost certainly infective—the fever, the local infection of the tonsils, the endocarditis, all point to a bacterial infection, while in addition there is the analogy of the other joint affections, which are certainly bacterial. Further, it will not be forgotten that in scarlatina there often develops a form of rheumatism, the symptoms and heart complications of which are practically identical with those of rheumatic fever; and scarlatina, of course, is a tonsillar infection.

So far as preventive treatment is concerned, it is clear that no sore throat and no growing-pain is too mild to be heeded. Once the rheumatic fever has fully developed, the

patient, confined to bed and with his joints protected by cotton-wool, must be kept strictly to a milk diet, his articular pains being relieved by the administration of salicylic acid in one form or another. These measures may be gradually relaxed within a few days of the temperature subsiding, but if endocarditis should develop, the patient must keep to his bed, probably for several weeks, to afford the heart a better chance of recovery.

In **Gonorrhœal Arthritis**, or *gonorrhœal rheumatism*, the inflammation is set up by the gonococcus, the infection having become generalized from its local site in the genital tract. The arthritis, which generally begins within two or three weeks of the venereal infection, is unlike acute rheumatism in that it usually affects a single joint—perhaps the elbow, knee, or ankle—which becomes painful, tender, and swollen, the skin over it and for some little distance up and down the limb becoming of a deep and angry-looking red. Though the associated fever is less than in acute rheumatism, the arthritic inflammation is usually much more intense, subsiding only slowly, and often leaving the joint seriously damaged, if not, indeed, destroyed. For this reason the limb should be kept on a splint from the outset in such a position—*e.g.*, the elbow bent, the knee straight—that if the joint should become permanently fixed, the limb will still be a fairly useful member. The chief item in the treatment is, of course, the cure of the primary gonorrhœa, while for the joint itself, once the inflammation has subsided, passive movements and massage are likely to be required.

Septic Arthritis, a still more serious affection, is caused by septic organisms carried to the joint in cases of, for example, blood-poisoning. The effects are generally very severe, synovial membrane, cartilage, and bone all being involved, while the cavity of the joint becomes filled with pus, the constitutional symptoms being in keeping with the

intensity of the inflammation. The treatment is surgical, the joint requiring to be opened and drained, but the case may well come to amputation; even without this the patient is likely to be left with a stiff joint.

Pneumococcal and **Influenzal Arthritis** are as a rule milder in their effects than the preceding, but may require operative treatment, or at any rate aspiration of the joint to draw off the fluid; and a greater or less amount of stiffness is probable.

Osteo-Arthritis.—We now come to a more insidious and chronic form of articular disease, which has received a varied choice of names in keeping with the doubt hitherto surrounding its pathology; thus, in addition to osteo-arthritis, it is known as "rheumatoid arthritis," "arthritis deformans," and even as "rheumatic gout," though it has nothing whatever to do with gout. At the present day there is reason for the belief that osteo-arthritis is caused by micro-organisms or their toxins, absorbed over a long period of time from some chronic septic focus elsewhere—more especially from decayed teeth, or, more often, from pyorrhœa. Whatever the primary focus, however, the disease presents much the same symptoms. Occurring at almost any age, but more frequently between thirty and fifty, it affects women more often than men. In its most characteristic form the knuckles and finger-joints become swollen, stiff, and painful—not acutely, but in the course of weeks. Later some of the bigger joints, such as the shoulder or knee, may be involved. The symptoms are variable in intensity, now better, now worse, but (the primary focus not being cured) tend to grow worse with the lapse of months or years. All this while the joints are slowly but steadily becoming destroyed. At first the synovial membrane becomes thickened, next the articular cartilages become rough and cracked, and are gradually worn away by the friction of the joint until the naked ends of the bones are exposed. Now

the bone itself is attacked; in one place it, like the cartilage, becomes eroded; in another it is rubbed smooth and ivory-like, while in a third irregular excrescences (they can often be felt beneath the skin, especially in the fingers, where they are known as "Heberden's nodes") make their appearance. All this, of course, spells pain, deformity, stiffness. Finally, the ends of the bones, denuded of their cartilages,

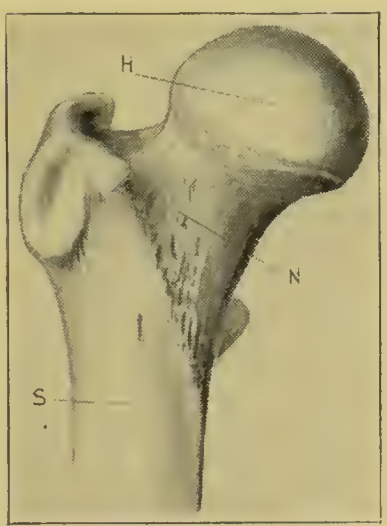

FIG. 19.—NORMAL FEMUR.

FIG. 20.—OSTEO-ARTHRITIS OF FEMUR.

On the left (Fig. 19) the upper end of a normal femur, showing the shaft (*S*), the neck (*N*), and the smooth, cartilage-covered head (*H*), which forms part of the hip-joint. On the right (Fig. 20) the corresponding part of an osteo-arthritic femur, the head having been almost worn away, while great excrescences of bone have grown out at *E*.

may begin to grow together, the excrescences lipping their edges meet and fuse, until in the end no joint remains, and the two bones are as solidly united as if they were one.

Though involving no risk to life, osteo-arthritis may be the cause of years of suffering, for unless the condition is treated in a comparatively early stage, before any structural damage has been done, not a great deal can be effected by way of cure. In the early stages, however, first aid must

usually be sought from the dentist. Once the mouth is put right the outlook is more hopeful. By a generous dietary, cod-liver oil and iron, together with hot-air baths, massage, etc., to the joint, the disease, if not altogether curable, can often be checked.

Gout.

Gout, a disease which has yet to find its exact place in medical classification, is clinically related to the various rheumatic affections, though no infective origin has been brought home to it. Its two outstanding features are—(1) Attacks of acute arthritis, and (2) the gradual deposit of uric acid (sodium urate) in and around the joints. The earliest indication of the disease is usually an attack of intense pain in the joint of the ball of one or other great toe, which becomes swollen and tender, the skin over it looking purplish and shiny. This largely subsides in the course of a week or fortnight, the skin peeling off in flakes, and the patient feels well enough for months or years until, in a second attack, the other great toe, or perhaps some other joint, is involved. Finally, several joints become affected, each being left more or less injured. By the time this chronic stage has been reached, the joints get filled with the white uratic salts, and these, distending the overlying skin, may ulcerate through and escape as so-called "chalk." At the same time other uratic deposits are likely to be found beneath the skin of the ears, where they are known as "tophi." Meanwhile the joints become stiffened and deformed. Finally, Bright's disease (chronic granular nephritis) is likely to develop—though why it and gout should go hand in hand is not understood—and the patient is then exposed to all the risks of this new affection.

It should be further explained that, during the acute attack, the urine contains only about half its normal quantity of uric acid, the blood, on the other hand, becoming

at this time highly charged with the substance—an association lending support to the belief that gout is due to some chemical constitutional derangement causing the system to be overladen with uric acid. The problem, however, is not easily solved, though this much is certain, that uric acid is derived partly from the cells of the body, partly from animal food. The former source cannot be controlled, but the latter can be stopped by a special dietary from which are excluded all those chemical substances (known as "purin bodies") which bear a close chemical relationship to uric acid. For this reason the "purin-free" diet (see p. 33) is commonly accepted as a preventive measure in the treatment of gout. Apart from this the disease, in its acute attacks, is treated by the internal administration of colchicum, the joints themselves being protected by cotton-wool or warm fomentations.

CHAPTER XXV

DIABETES—RICKETS—INTOXICATIONS

Diabetes.

DIABETES, or, to give it its full name, "diabetes mellitus" (Latin *mellitus*, sweetened with honey), is the disease which is characterized by sugar in the urine (glycosuria). It may be said at once, however, that not every patient with glycosuria is suffering from diabetes; on the contrary, sugar may be present from a variety of causes (one of which, for example, is the eating of an excessive quantity of sugar), while many people, men particularly who are getting on in years, habitually excrete small quantities without being much the worse for it. On the other hand, true diabetes is always a serious condition, and in a considerable percentage of cases is fatal. It occurs at any age, but more frequently at or after middle life, and affects men more often than women. Its *cause* is not known, though several theories have been put forward by way of explanation. At present the weight of evidence goes to show that it is a disease not so much of any one organ as of the tissues generally, whereby they are unable to deal in a normal fashion with the sugary constituents of the food; but whether this defect lies in the cells themselves, or is dependent on a pathological disturbance of the internal secretions, especially of the pancreas, or of a morbid condition of the functions of the kidneys, of the liver, or even of the nervous system, has

yet to be decided by research. It is known, however, that diabetic blood contains an undue proportion of sugar, and that this is usually accompanied by highly poisonous acids, the chief of which is oxybutyric acid; indeed, this acidity, or "acidosis," is responsible, as will be pointed out later, for one of the gravest complications of diabetes. Briefly, it may be said that a diabetic is unable to put to its proper use the carbohydrate elements of his food when they are absorbed into the circulation. Nevertheless, even when carbohydrates are excluded from the dietary, it by no means follows that the glycosuria will cease; in other words, some of the sugar in the urine must be derived from the patient's own tissues.

Whatever the exact pathology, however, the clinical features of the disease are distinct enough. Beginning as a rule insidiously, though sometimes acutely, the earliest *symptoms* to be noted by the patient are a great thirst—which can be relieved only temporarily even by large draughts of fluid—and the passage of great quantities of urine. At the same time the patient begins to lose flesh, and often develops a rapacious appetite in keeping with his thirst; his physical energy is sapped; he becomes irritable and depressed.

If observations are now made on the *urine*, it will be found that the daily excretion, instead of amounting to the usual three pints, is as much as ten, fifteen, or even more pints, which are pale and watery, and yet possess a high specific gravity—1030 to 1040. This is due to the large quantities of dissolved sugar; in many cases a pound or more thus runs to waste every day. Its presence in the urine can be readily detected by appropriate tests, chemical or physical, the most useful being that devised by Fehling, who turned to account the fact that if the clear blue solution of the sulphate of copper is boiled with sugar, a copious precipitate is produced, varying in colour from a brilliant

scarlet to a dingy yellow. This test is applied in the following way :

Fehling's Test.—Place in a test-tube some copper sulphate solution (Fehling's solution, No. 1), and add to it an alkaline solution (Fehling's solution, No. 2), containing caustic potash and sodium potassium tartrate, until a clear ultramarine mixture results. To this add a few drops of the diabetic urine, and boil. Even before the boiling-point is reached the colour of the fluid changes to scarlet or yellow, as mentioned above.*

As may be supposed, diabetic sugar is liable to irritate the mucous membranes in the neighbourhood of the urethral orifice, and this is especially likely unless scrupulous cleanliness of the parts is ensured ; without this there will probably follow inflammation with intense itching—balanitis in men, pruritus vulvæ in women. Nor are these the only skin complications, since eczema is frequently added to the other troubles of diabetics, while boils and carbuncles are common features of these cases. An even more serious complication is peripheral neuritis—set up, presumably, by the toxic condition of the blood—which may so interfere with the nutrition of the limbs that their extremities, especially the toes, become gangrenous.

None of these complications, however, can compare in importance with those which affect the lungs—namely, acute pneumonia and tuberculosis. Indeed, it has been estimated that a fatal issue in diabetes is due to these pulmonary affections in one case out of four. Yet even now the gravest complication of all remains to be mentioned. *Diabetic coma* is responsible for the deaths of two out of four diabetics. This condition, which is de-

* While Fehling's test will show the presence of sugar, even in small quantities, it furnishes no evidence of the amount of the sugar. This must be determined by a rather more elaborate method, which, however, need not be here described.

pendent on the acidosis of the blood, may herald its approach by sleepiness, nausea, or headache, and soon brings the patient to a state of almost complete unconsciousness. It may be possible to half-rouse him, but the coma deepens, while at the same time the breathing becomes slow and deep—rather a succession of sighs than ordinary deep breathing—and death occurs almost inevitably in one, two, or three days.

Curiously enough, very little is seen post mortem to account for the disease, and but little help is derived from this direction in the way of *treatment*. The indications, however, are to control the consumption of carbohydrate food, from which so much of the sugar in the blood and urine is derived. A diabetic diet, therefore, excludes all sugary and carbohydrate materials (bread, potatoes, and most vegetables, farinaceous puddings, pastry, fruit, beer, sweet wines, lemonade, etc.), and limits the patient to meat, poultry, clear soups, eggs, cream, spinach, blanc-mange, gluten bread, etc. The strictness of this none too palatable diet can, however, in most cases be relaxed, since many diabetics, though unable to deal with ordinary amounts of carbohydrates, can be safely allowed a more limited measure, the exact quantity being ascertained in each case experimentally, and controlled by the examination of the urine. Apart from diet, opium (including its alkaloids, morphine, and codeine) has a decidedly beneficial influence. With regard to diabetic coma, the special treatment is based on the fact that it is dependent on an acid intoxication or acidosis, and the method commonly followed is to administer alkalies, especially sodium bicarbonate, in large doses either by the mouth or by intravenous injections.

Rickets.

Rickets, which is a nutritional disorder affecting more particularly the growth of the bones, is necessarily restricted to early life, when the bones are still actively lengthening,

and usually occurs in the first eighteen months of life, when children are wholly at the mercy of ignorant methods of feeding. Its cause is probably to be identified with an insufficiency of fat, and, perhaps, of protein. The most significant pathological change is found in the bones, which contain far too little calcareous salts, and, as a result, are unduly soft, yielding readily to pressures which a healthy bone would withstand. For example, if the child is old enough to stand, the weight of the body is more than the shin-bones can support, and the legs become bowed; if, on the other hand, the child is content to sit, the pelvic bones become pressed out of shape, perhaps with disastrous consequences to females when, in later life, parturition is in progress. Similarly, the softened ribs, unable to resist the drag of the intrathoracic pressure (see p. 127), become drawn in, producing a characteristic deformity of the chest, and pushing the liver and adjacent organs downwards until the child looks pot-bellied. Yet another fairly constant result is seen in the teeth, the eruption of which is commonly delayed. Further, the cranial bones are involved, the fontanelle remaining open, and the shape of the head, especially the forehead, becoming prominent. With all these changes the child is probably not wasted but, rather, is heavy and fat, and not a great deal is likely to be made out amiss in the soft organs, unless it be that the spleen is enlarged.

The disease begins insidiously, the infant probably becoming fretful and pale. Before long, little lumps can be felt where the ribs join the rib cartilages—the so-called "rickety rosary"—and the ends of the long bones, especially of the radius and ulna at the wrist, become thickened. The treatment, both preventive and curative, is dietetic. Indeed, it may be taken for granted that a child found to be rickety stands in need of some alteration, great or small, in its feeding. Once this has been attended to, a gradual

recovery is usual, though in a minority of cases some permanent deformity or perhaps stunted growth will be the penalty.

Intoxications.

This is the name given to those diseases which are the result of chronic poisoning by alcohol, lead, arsenic, mercury, carbon bisulphide, morphia, chloral, etc. Of these the most important are alcohol, lead, and arsenic, and the following account will be restricted to these three, each of which is a common cause of serious and even fatal illness.

Alcoholic Poisoning.—Acute poisoning by alcohol, *i.e.*, drunkenness, hardly calls for any description here, except that when an excessive amount of alcohol has been rapidly absorbed from the stomach, the patient may become comatose ("dead drunk")—a state the diagnosis of which from other forms of coma, such as apoplectic and uræmic, may not be easy. In *chronic alcoholism* the effects fall most heavily on the digestive, circulatory, and nervous systems. The alcohol, by irritating the lining of the stomach, produces chronic gastritis, with loss of appetite, nausea, and morning sickness. Further, in many cases it produces cirrhosis of the liver. In the circulatory system the heart is specially affected, becoming enlarged and fatty—"beer-drinker's heart"—a result more often seen in Germany than elsewhere. The most serious effects, however, are seen in the nervous system. The patient becomes irritable and forgetful, his hands and tongue are shaky, his temperament changes, the symptoms culminating, perhaps, in insanity. Again, chronic alcoholic poisoning is a cause of peripheral neuritis, which leads to paralysis, and at the same time induces a curious mental state in which the patient's memory for recent events is lost; for instance, a patient lying in bed paralyzed by neuritis will describe a wholly imaginary expedition of a few hours before. Yet another result of chronic alcoholism is *delirium tremens*, to which

topers are particularly liable at the time of some physical shock, such as a broken leg or the onset of pneumonia. The symptoms are those of acute delirium, the patient becoming very excited and violent. A feature of the attacks is the hallucinatory disturbance which causes the patient to see rats, beetles, etc., running about the room.

Lead-Poisoning (*Plumbism*).—This is most often seen in lead-workers, such as plumbers, house-painters, printers. Though the particles of lead in these cases may gain entry to the system by inhalation or through the skin, the more usual channel is from the alimentary canal, the lead being transferred from the fingers to the mouth, especially if the workman sits down to his meals without thoroughly cleaning his hands. The symptoms, which usually appear slowly, include anæmia, colic, and constipation, while if the gums are examined a blue line may be seen at their edges where they overlap the teeth; this line, which is due to a deposit of the sulphide of lead, is, however, inconstant, and is not likely to be found if the patient is in the habit of cleaning his teeth. In severer cases the symptoms of peripheral neuritis develop, the paralysis being most marked in the forearms, so that the patient's hands fall limply at the wrist ("dropped wrist"). Occasionally, but not very often, plumbism causes epileptiform convulsions, which quickly pass into a fatal coma.

Chronic Arsenical Poisoning is usually the result of inhaling particles of arsenic derived from certain green wall-papers, green fabrics, green artificial flowers, etc., but it sometimes follows the prolonged medicinal use of arsenic. The earliest symptoms are usually nausea, vomiting, and diarrhœa, and any of these occurring in a patient to whom arsenic has been prescribed should immediately raise suspicion as to their cause. Later the patient becomes anæmic, and finally is likely to develop peripheral neuritis and paralysis.

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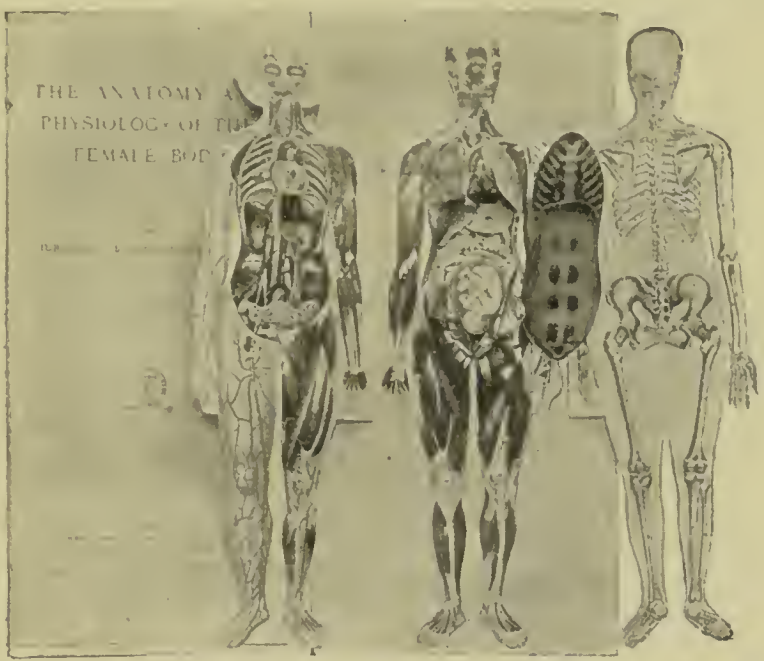

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